FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW
Editor

AUGUST 1935

How Pay Workers?

DO THE unusual plans for paying employees recently introduced indicate the beginning of a new trend in wage payment? We refer particularly to the Nunn-Bush and Hormel plans of paying on the annual income basis, detailed in this issue.

The philosophy on which such plans are based will bear looking into. After all, employees do not live by the piece, hour, day, or week. They live by the year. They rent houses by the year, sign for time payments by the year, send their kids to school by the year. When employed on the annual-wage-basis, they can look ahead just as salaried folk do instead of by the day, week, or season.

Never does the worker want a short pay envelope. Assured of his income for the year he will become an integral part of the organization. He will understand that the success of his employer is also his success. He will think many times before he joins a strike, and all of his fellows will be doing the same kind and amount of thinking.

That is one advantage to the employer, but there are others.

There is no longer the incentive for the workers to hold back in order to make the work last longer.

Workers will not tolerate other workers that are inefficient when they themselves pay the penalty in longer hours or lower annual incomes.

The plan is one that lends itself nicely to operation under employee representation systems. If it is properly handled, the worker will not be likely to insist upon selling his services on the short-time basis for all he can get.

Whereas the employer uses his cash to absorb the production ups and downs, he does not have to carry the whole burden because the worker uses his time for the same purpose, working longer or shorter hours as needed.

Labor cost is predictable throughout the year, can be accurately budgeted.

Employment is stabilized, which means less waste in training, in hiring and firing, in spoiled product.

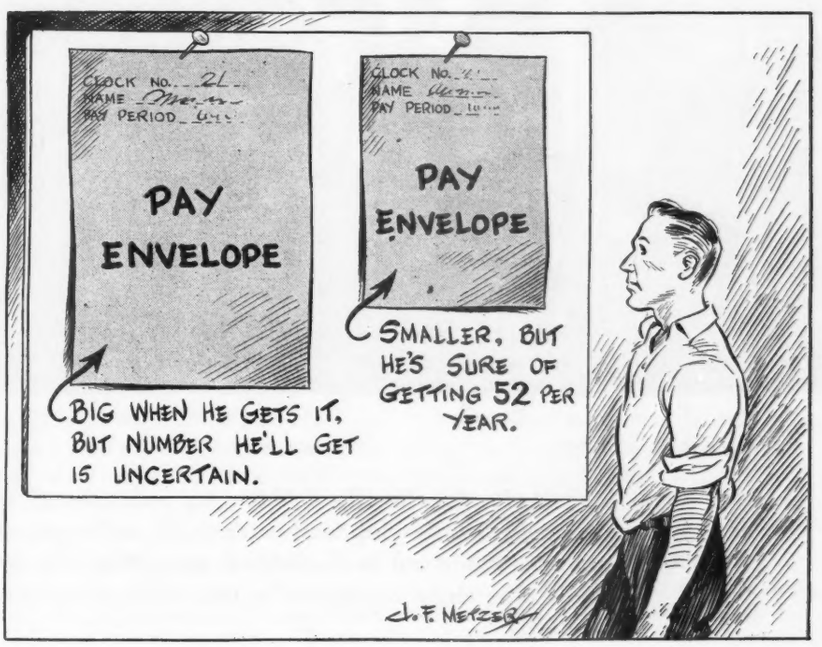
Would wide-spread adoption of the annual-wage plan of paying employees mean the death of incentive systems, be they straight piecework, premium, task and bonus, group-bonus, or other? Would it mean that job analysis, time study, motion economy, and other refinements of wage payment determination would go by the boards?

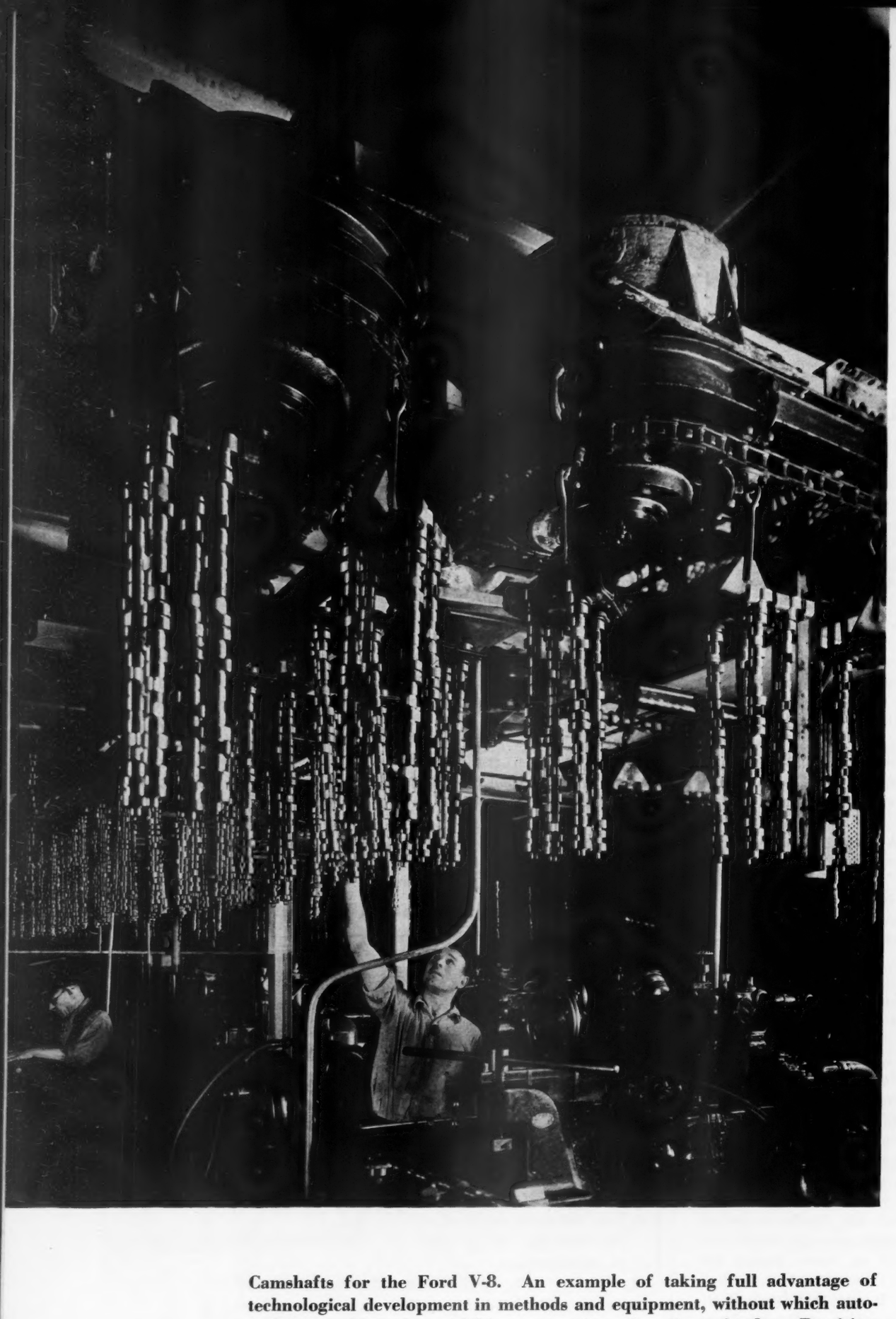
By no means. An inefficient plant is about as likely to go under if it pays its employees by the year as by the piece. There cannot be any workable substitute for good management in process and method determination.

Ordinarily agreements between employer and employee will be made by the year. This year's agreement will be based on past performance, which presumably was an approach to standards set up after measurement of tasks by the usual management tools. This year's performances will be measured in turn, and new standards set up to allow for technological development, and to insure that cost cutting emanates from equipment, not from wages. Obviously, management's tools of measurement would not be obsoleted.

It is important that we check up to find out whether or not the pendulum has swung too far in the direction of piecework and other wage incentive plans without taking into consideration the workers' total living requirements. The plans of Nunn-Bush and Hormel—and others—are a beginning. Let's understand them, watch developments, learn from them.

Which one should he have?





Camshafts for the Ford V-8. An example of taking full advantage of technological development in methods and equipment, without which automobiles would not be available at many times the prices of today. Precision tools plus chain conveyors in this instance contribute toward the national mobility

Paid by the Year

Long hours this week, maybe shorter hours next, *but the same pay check every week*

ARTHUR VAN VLISSINGEN, JR.
Special Correspondent, Chicago

THIS story is told with no idea that the company from which its facts are drawn has hit upon the final solution for all industrial ills. Rather, it is submitted for whatever value it may have to other manufacturers in their struggle to give their men a square deal and have enough cash left over to remain solvent. It is an unadorned account of certain difficulties that face a good many concerns.

The firm in question undertook to work out for these problems satisfactory solutions, which so far seem to be working out better for employees and management and stockholders and everyone concerned than did more conventional methods. The company is George A. Hormel & Company of Austin, Minn., one of the larger of the independent meat packers.

In most industries, jobs not on direct incentives may be arbitrarily classed by what controls the workers' speed: (1) Conveyors or other mechanical pacemakers; (2) only the driving force of the foreman. In many plants some jobs are practically unsupervised, the men are so widely scattered.

Obviously it is to the advantage of the management to have both classes of work done as rapidly and skillfully as possible. Yet speeding up a pace-setting conveyor brings accusations of slave driving. On unpaced jobs the management is almost at the mercy of the employees. Everybody from the president to the sweeper knows, too, that it is good plant ethics for the better workers to cover up the deficiencies of their less competent fellows by themselves slowing down.

In most businesses unavoidable seasonal fluctuations must likewise be met. This is true in meat packing, of course. Says Jay C. Hormel, president of the company:

"We buy what live stock is offered, and we have to slaughter it then. Our average rate of operation in pork is 1,000,000 hogs per year. But instead of coming to us in a nice even flow of about 20,000 hogs each week, some weeks see 35,000 hogs dumped at our door and other weeks see only 10,000. We cannot afford to feed the animals for an indefinite time just to level out our schedules. We must face fluctuating loads.

AGREEMENT
between
GEO. A. HORMEL & COMPANY
and

.....
Name *Clock No.*

IN consideration of my receiving my regular straight-time weekly salary during the year beginning March 18, 1935, I agree that to the best of my ability I will fulfill the conditions of the revised straight-time agreement submitted by the Company dated March 14, 1935, to the Killing Departments and March 16, 1935, to the Cutting Departments, and during the three years ending March, 1939, make up the work I am short this year.

March ..., 1935
Austin, Minnesota

.....
(Signature)

Necessary part of the yearly pay plan is the arrangement to set up credits—in a year of light hog supply—to be paid off later. Hence this agreement between company and employee

Labor Costs Fluctuate

"Even in a machine-paced operation such as hog killing or pork cutting, labor costs fluctuate with employment. Every time we received so many hogs that we had to hire another hundred men for the killing gang, costs soared until these men could develop their skill and until the old workers who had been doing two operations got used to doing only one. Then, when operations shrank and we laid off some men, the men retained were left-handed at their doubled-up jobs for another couple of weeks, with the dual result of less skilled workmanship and higher unit costs.

"It costs money to hire and fire—even on a conveyorized operation. As for the jobs where speed depends only on the foreman, these costs fluctuate even more violently under up-and-down conditions.

"We worried about this situation for a long while. For one thing, quite aside from the effect upon costs and quality, we do not like pulling into our temporary employ some strangers who mean nothing to us and to whom we mean quite as little; then after a few weeks of work at minimum rates—since they get the unskilled jobs—throwing them back on relief. It is not good economics to keep in our town or any other town a pool of unemployed who do useful work only once in a while when some plant needs then for a few days or weeks."

So the Hormel management began to think back into the fundamentals. What, the executives asked themselves, did they want in respect to wages? Answer: (1) Predictable labor costs per unit of production; (2) lowest labor costs consistent with fair earnings.

What employees most want in respect to wages is almost as simple: (1) Predictable incomes, steady and adequate — sometimes labeled "economic security"; (2) level rates of income fitted to budgeting expenses, desired by youngsters so that they can buy automobiles on time payments and know they will not lose them by layoffs or by making too

A typical group on the weekly rate. Where conveyor or machine paces the work, workers now complain that it operates so slowly that they are kept longer hours than necessary. This is the same pacemaker that used to work them to death

little some weeks, desired even more urgently by older men with family responsibilities; (3) above all, and this may be illogical but certainly it is human, they want absolutely never to receive short pay checks, even though they may have had long pay checks for several weeks.

The specifications thus outlined seemed to the Hormel management to point toward putting their people on a weekly rate rather than the hourly method on which they were then working, and also rather than some form of compensation based on individual or group production. Either hourly or piece rates would give some short pay checks, varying with the supply of live stock, and workers seldom remember the long checks on a short pay day, although they remember the short checks for years afterwards — which proves they are human beings who react about as you and I do.

If however, the plant employees could be put on a weekly wage, for which they must give a production of specified amount over the year (easily predictable), this means of necessity that the employer absorbs the ups and downs of production with its cash, while the workers absorb them by working whatever hours they are called upon to work.

This weekly wage idea was not tried on a large scale without small-scale experiment. The smokehouse employees had been placed on the weekly wage some while before and found it as much to their liking as it was to the management's.

After the idea had been thus tried out, the management announced a similar plan for the entire plant. To everyone's surprise, in the atmosphere of misunderstanding and doubt that surrounded most compensation ideas during 1933, this permitted a good deal of dissatisfaction to come to the fore—so much, indeed, that after a short period the plan was withdrawn from every part of the plant. (Every part, that is, except the smokehouse, where the employees practically insisted on remaining on the weekly wage).

Changed Their Minds

The men in one large gang were hottest against the weekly wage plan. When the management canceled and put them back to work at hourly rates, an executive prophesied to their representative that before long they would be sorry, for reasons entirely beyond the management's control.

Sure enough, the company began meeting a short run of hogs. Time slackened proportionately, and the gang members felt it in their pay envelopes. Strangely enough, they came to the management and asked to be put on a flat weekly rate—the thing they had rebelled against a few months earlier! After some dickering, the management agreed to put it into effect on their floor if they would settle down and give up some of their recently developed bad manners.

"When we talk about a weekly rate," explains Jay C. Hormel, "this is slightly inaccurate. To be sure, we do pay a flat weekly rate in those departments where this method is in effect. But from our standpoint it is a flat yearly rate, and our agreement with the men makes this clear, although it holds to the weekly nomenclature. Accurately, we call it our 'straight-time' plan.

"The straight-time plan is based on the number of man hours necessary to do the work of handling the year's normal volume—in the hog and pork departments, a kill of 1,000,000 hogs. We find the normal number of men required to do this work. During heavy runs of hogs, they work longer hours for their weekly pay. During lighter runs, they work shorter hours. The money in their pay envelopes remains the same no matter how many hours they work during the week. Unit labor costs fluctuate wildly from week to week, but so long as our annual kill comes out at 1,000,000 we get precisely the labor costs we figured on.

"We have, you see, a given amount of work to turn out in any day, whether it be 2,000 hogs or 6,000. We set the men to do this task at starting time; when they finish they may go home. Whatever hour they get through, they still earn the same weekly pay. Now the men complain because the conveyor that paces them operates so slowly that they feel they are kept longer hours than necessary. This is the same conveyor that used to work them to death, the only difference being that we have speeded it up somewhat in accordance with their desires."

The straight-time plan worked beautifully in this department.

As the end of the one-year agreement drew near, however, there arose a real difficulty. Restrictions on hog-raising that came from government control, plus the 1934 drought, forecast a light hog supply for at least the next year. Should plant departments keep straight time but reduce the rate? Or should they fall back on hourly wages? Or perhaps cut down the gang and keep straight time?

The Credit Idea

A detail of the expiring agreement provided an idea. It had been provided that, in addition to six designated holidays with pay, the men should be entitled to six days of absence or vacation with pay per year. If a man exceeded his allowance, he would be docked. But if the gang managed to take up the slack and permit the plant to operate without replacing that man, the wages thus saved would be credited to the gang. The management promised the distribution would be equitable. What actually happened is that it was distributed equally

among the men in the gang, about $8 per man.

Anyhow, here was the germ of an idea of setting up credits to be paid off later. The company extended it to working hours. It offered the gang a proposition that included the following terms—they are slightly condensed to save space:

"The gang is set up for 580 hogs per hour, and this will be considered as one hour gang work. The company will continue the same weekly salary basis . . . and will continue to keep score on the basis of a 36-hour basic week . . . Records will be kept and the hours less than 36 worked by the gang will be considered as an advance or loan. In the three years following the third Monday in March, 1936, this time is to be made up . . . If any time is still not made up by the third Monday in March, 1939, the unpaid balance will be written off by the company, provided the employees have carried out their part of the agreement . . . The hours gained by the gang due to the docking of absent employees will act as a credit against the hours the gang owes. One man hour will be equivalent to 3¼ hogs."

Individual Acceptance

A committee was set up to handle this agreement, and each member of the gang was required to signify his individual acceptance by signing a formal agreement. It was finally stipulated that should any member of the gang leave the company's employ, his share of the obligation would not be considered the obligation of the gang—in other words, the company would write it off.

If so much description is devoted to the arrangement with this one gang, do not assume that only this gang is working on straight time. The fact is, of some 2,400 employees in this plant, 1,436 are on straight time on the day this article is written. This means, of course, that the employees in over half the departments are assured full-time employment throughout the year at a steady weekly salary, and that on this proportion of all operations the company is assured an even unit labor cost throughout the year, however it may fluctuate from week to week. (In those departments where the plant is working on an advance or loan arrangement like the one just cited, it is of course taking higher unit labor costs during 1935 than in a year of plentiful live stock supply.)

"We firmly believe that it is our obligation to provide steady employment," is how the company's credo is stated by M. F. Dugan, treasurer. "Ours is the principal source of employment in our community, and until a short time ago there were only 228 families on relief in the entire county. Since then, two fluctuations—both beyond our control—have caused a good deal more unemployment, chiefly among people who came into the community looking for work with us.

Steady Employment

"One of these is that we started in 1931 a construction program that was finished up last fall. This put a good many building trades workmen out of work. The other was the influx of people into Austin to work for us during the sudden expansion of operations last summer to care for the drought cattle and Federal Surplus Relief Corporation canning operations. We had to do this work right then, before the cattle should die. We hired employees just as fast as we could get them, on temporary terms to finish up this job. People came from as far away as the Pacific Northwest to get this work. When the rush ended, most of them went on relief.

"So, to this extent, we have contributed to local unemployment, though the individuals are chiefly those who would be unemployed elsewhere if they were not in our town. But our regular plant force is right back where it was a year ago, almost man for man. And so far as we can foresee, here it will remain at least until the supply of live stock is replenished by the none too rapid processes of nature. Every morning we hire a few people for temporary replacement of absentees, but that is all.

"We have gone to a goodly length to hold our employment level. For example, a while back we were approaching the regular seasonal interruption in the manufacture of one of our canned products. At the same time, we had on hand a lot of surplus FSRC cans. We made a dicker with the Bureau of Animal Industry to use up the cans, put on the market a new product called 'Old Fashioned Beef Stew,' and swung the surplus employees into this operation—we were entirely willing that it be only temporary. However, the product caught on. Presently we found ourselves buying new cans and organizing the personnel into a permanet crew for putting out this product. We have gone through similar experiences several times during the past couple of years."

It seems needless to amplify the reasoning of the above paragraphs. Any experienced manufacturing executive knows at a glance the advantages that come to employer and employed from this straight-time plan. George A. Hormel & Company is keeping its men at work and does not find — as it had sometimes previously found after a layoff—that some key men, skilled and unreplaceable locally, have left town for jobs elsewhere. It avoids fluctuations in unit cost and in skill of workmanship due to turnover.

All told, this set-up has so far proved out one of those ideal arrangements that shows a profit for everybody concerned, employer and employees, community and consumers. Maybe it would not work out so for you. At that, it may give you an idea you can profitably use.

Where men are widely scattered—as in this freezer—supervision is next to impossible. With the flat weekly rate every week, close supervision becomes unnecessary

These Plants Borrowed

Government is helping banks to lend, employers to borrow. Putting idle capital to work will mean more prosperity

MONEY for plant rehabilitation, modernization, new equipment, and working capital, lies ready for borrowers in the reserves of three national agencies. *Factory* told the story of RFC (NOW TO GET THE MONEY) in May, and in July described the procedure by which FHA and Federal Reserve Bank loans could be procured (MODERNIZATION MONEY).

With Impressive Results

Is industry availing itself of these opportunities to get the wheels turning again, and more efficiently? Yes, and with impressive benefits.

FHA, you will recall, aims to advance credit by insuring loans up to $50,000, made by your local bank for repair, alteration, or improvement of real property already improved by or to be converted into industrial plants, or for purchase and installation of equipment and machinery necessary to the operation of these plants.

These loans carry an interest charge not exceeding the equivalent of a $5 discount for $100 face amount of a 1-year note payable in monthly installments. In equal monthly installments over a period of not more than 5 years the loans are paid back.

Federal Reserve Bank loans to industry are made under Section 13 (b) of the Federal Reserve Act to provide working capital. Broad interpretation of the law enables banks to classify money advanced for equipment and machinery necessary to operation as "working capital." These loans you negotiate with your local banker or, if he turns you down, with the Federal Reserve bank in your district. If he does make the loan, your banker can sell it to the reserve bank and get that bank to make a commitment to take it. In either case the federal bank may absorb 80 per cent of any loss which results from the loan, in effect an insurance scheme.

Throughout its life *Factory* has consistently advocated modernization for profit. Has told many a story of profits from modernization.

In April of this year strongly advocated modernization of buildings.

In May told of one way to get the money.

In July told of two other ways.

Now tells here of how plants have borrowed, and what for.

It is as sound today as ever to modernize for profit.

No limit exists for amounts of individual loans; one has been made for $6,000,000. They may be made for any period up to five years at the going rate of interest in the district, usually anywhere from 4 to 6 per cent. Payment is made in full at date of maturity or according to any arrangement customary in making commercial loans.

Liberalized RFC Loans

RFC loans, considerably liberalized since the establishment of the Reconstruction Finance Corporation, and aimed at increase of employment, may be obtained for purposes of rehabilitation, new and additional equipment and machinery, new enterprises, industrial construction, and payment of debts and taxes. Obtained directly from the RFC, the loan must previously have been refused by local banks. Or the RFC may participate with the banks up to 80 per cent of the amount of the loan.

Loans up to $500,000 can be made at interest rate of five per cent, or at any other rate that the RFC may set. If made for capital expenditures, the loans must be amortized within ten years; for other purposes, within five years.

Deemed It Wise to Borrow

Here are typical examples of manufacturers who have deemed it wise to seek loans.

Manufacturer of machines for peeling potatoes and cleaning spinach had been supplying Navy vessels, but he saw a chance of profitable business in hotel and civilian trade. He had no capital for this expansion, but since he had conducted his business conservatively and had some unencumbered real estate, he felt that application for a loan from one of these national agencies would be in order.

In New Orleans eleven companies have filed applications for more than $250,000 to be applied to modernization programs.

A small cannery, for whose product a favorable price situation prevailed, needed money to put up the year's pack. The local banks couldn't see the loan, so the few thousand dollars required was borrowed from the national agency, and paid off before maturity.

Application for $100,000 was made by a company whose statement showed it to be insolvent. Prospects of a profitable volume of business and land, buildings, and machinery appraised at $200,000 were excellent evidence to present in justification of the application. After several

corrections in the financial structure had been suggested and accepted, the loan was granted.

A company manufacturing rubber products had been in hot water since 1928. A receivership and new owner had helped some, but the business was not profitable. Local banks refused to advance money so application was made for a loan of $100,000. After mortgages on real estate and equipment had been offered, and creditors had agreed to subordinate their claims, the loan was granted. Trade prospects are good, and the company has made its first payment.

Got Two Loans

One manufacturer of varnishes received two loans—one of $20,000 and a later one of $5,000—on the strength of fine reputations for product and management. Pick-up in the business in 1934 showed the need of more working capital to prepare for anticipated increases in sales. When banks refused application for a loan because of the competitive nature of the business, a national loan was obtained upon assignment of accounts receivable.

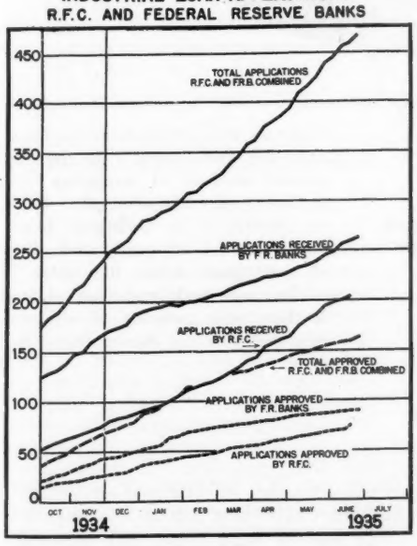
Engaged in the manufacture of sheet metal products, one enterprise had got into hot water through bad financial practices. It had an excellent market and had been operating profitably. Since it was already heavily indebted to the local bank, no more money was available from that source. The bank agreed, however, to subordinate part of its claims and include the remainder as a share of a loan made with one of the national agencies. The money obtained was used to retire debts and financial inventories and accounts receivable.

Another plant, making sanitary products for industrial plants, needed working capital. Its financial condition was good as a result of drastic retrenchment during the depression. It had a good product, good prospects, and a president whose business reputation was first-class. It asked for and received $15,000 to provide for increased sales. The money was used to carry accounts, discount bills, hire labor, and finance sales activities.

Working capital was a need of still another manufacturer who applied for a loan of $60,000 with which to pay up trade debts, retire a small mortgage, buy $4,000 worth of new equipment, and furnish working capital to level off peaks and valleys of operation. The plant made gears for the automotive trade, and had only run into difficulties because at two different periods in the firm's history sales outlets had suddenly disappeared. The new sales drives needed after each misfortune had eaten up the working capital.

Careful estimate of business prospects for the year ahead showed excellent profit expectations if working capital could be obtained. Heavy indebtedness to the local banks precluded possibility of a loan from that source. That bank did, however, participate in the new loan to the extent of $20,000 of the $60,000. The remaining $13,000 for which it was a creditor it subordinated to the new federal loan.

INDUSTRIAL LOAN APPLICATIONS
R.F.C. AND FEDERAL RESERVE BANKS



NOTE: R.F.C. figures of applications received include only those forwarded by the loan agencies to the head office in Washington. All applications submitted to Federal Reserve Banks receive final action at the banks and are not forwarded to the Board in Washington.

Proof that industry has been asking for loans (and getting them). No curve for FHA appears, for its industrial loans have barely had time to get under way

Bonus Plans on the Increase

PREMIUM and bonus systems of wage payments in effect in 1935 cover approximately three times as many wage earners as in 1924, according to data collected by the National Industrial Conference Board in a survey of financial incentives. The proportions of wage earners on piece rates has dropped two-fifths in the same interval, while the proportion on time rates is much the same.

The Board's report covers 631 companies employing more than 700,000 wage earners.

Premium or bonus plans are relatively more popular in medium-sized plants than in either very small or very large establishments. In plants employing between 250 and 999, 23.2 per cent were being paid under premium or bonus plans; in plants employing from 1,000 to 4,999, 24.4 per cent. This contrasts with the percentages in the small plants and large plants, 14.1 and 19.9 per cent, respectively.

Straight-time rates are most common in the automotive industry where 83.4 per cent of the workers are paid on that basis. Individual piece rates lead in the clothing industry, 80.4 per cent of the workers being compensated on that plan as compared with 15.7 per cent on straight time and 3.8 per cent on premium or bonus plans.

Reports from printing and publishing establishments indicate that 54 per cent of wage earners are on premium or bonus plans, 44 per cent on straight time, only 2 per cent on individual piece rates.

Effect of NRA

Three companies reported that NRA had increased the use of incentives to every one that found it had the opposite effect. Main reason for increased use of incentives on account of NRA was need for greater economy. This need arose from the increase in costs resulting from reduction in working hours and establishment of minimum wage scales.

Many companies pay all employees on the basis of time rates. It is very rare, however, for all employees to be paid by any method other than time. Frequently a large proportion of total working force is under incentive, but usually there are some types of work that do not seem to be adapted to incentive methods.

Training the First Operator

Is often the hardest part of installing improved methods. Some reasons why it's poor psychology to pick your best girl

M. L. McKEAND
Industrial Engineer, A. B. Segur & Company
Oak Park, Ill.

"THE HARDEST part of the installation is to get the first operator up to standard speed." That is one of the first remarks we hear whenever the installation of improved methods is mentioned. In my experience the difficulty has been 90 per cent mental.

Selection of the first operator is generally made with the best intentions on the foreman's part. The operator with the highest production record is selected on the basis that if anyone can do the work by the improved method this operator will be the one.

As a matter of fact this operator is almost the poorest choice that could be made. In the first place she has mastered the operation by the present method and enjoys a sense of security because she is probably held over all the slack periods when less skilled operators are laid off or work part time.

Consider Her Pride

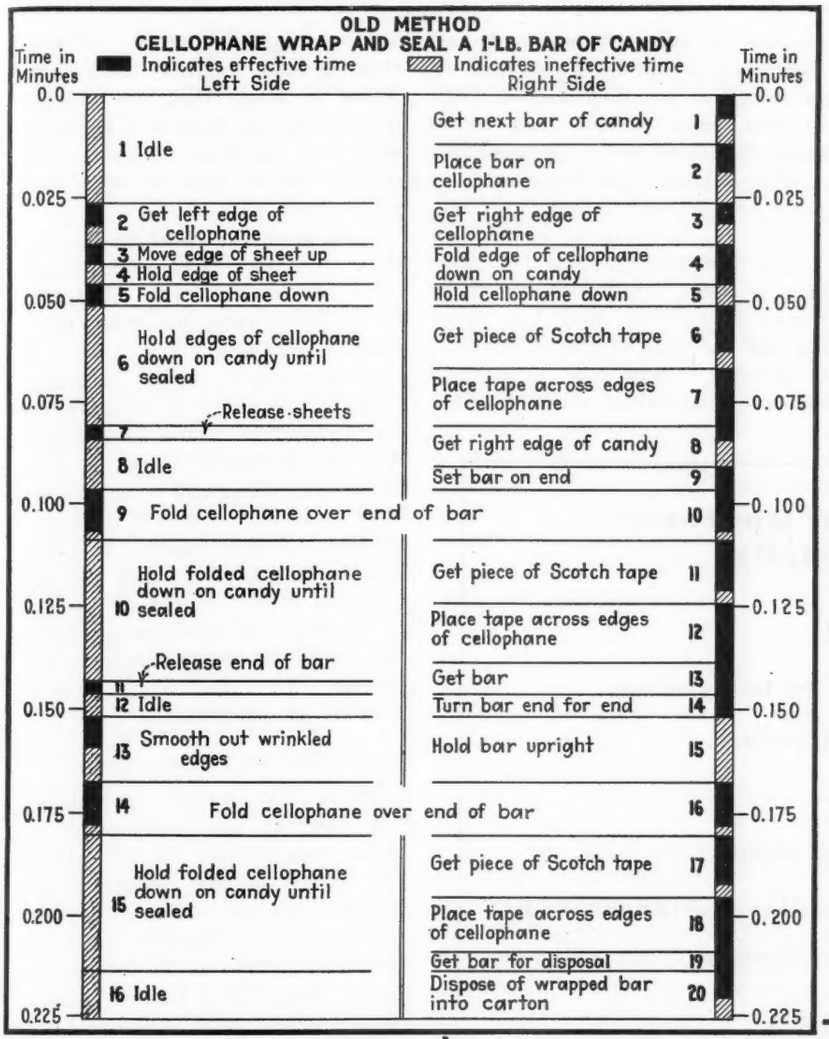
In the second place her pride is in danger when the new method is introduced. She has enjoyed being pointed out as the star operator. With the new method she must re-learn the operation, and knows that some of the other operators may soon pass her because she has lost the advantage of her special skill. The new motion layout has eliminated some part of the present method in which she was especially skilled; therefore all other good operators have an equal chance with her. Probably some of them will soon exceed her. Then she becomes a second-rate operator while some other girl enjoys the advantage of being the best in the department.

This operator knows that if the new method fails she will maintain her position as the best operator. Is she overly anxious that this new method prove a success? Naturally not. Perhaps she will honestly try to follow instructions, but any new method is harder than something that she has been doing for years. Every little difficulty looks big; she did not have that trouble when working under the old method. The engineer may change the method a little. That adds to her misery; she becomes discouraged. Perhaps her production the second day she worked on the new method was about half what it would have been on the old method. Her friends laugh at the amount of work she turned out. Her pride is wounded.

Foreman and production engineer train the first operator in the improved method of wrapping and sealing a 1-lb. bar of candy. Folding fixture is a U-shaped block that holds bar of candy and sheet of cellophane while the latter is folded and both ends are sealed. Motion time analyses of old and new methods are shown across the page

If she is well liked, she will feel bad when pressure is applied by many of the other operators. Many disagreeable remarks will be made to and about her for spoiling the rate. To the other operators the new method is impossible; they think they will not be able to earn a fair salary.

If she cares for the opinions of others, she will be influenced by their remarks. I have trained oper-


OLD METHOD
CELLOPHANE WRAP AND SEAL A 1-LB. BAR OF CANDY
Indicates effective time
Indicates ineffective time
Time in Minutes
Left Side
Right Side
0.0
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
1 Idle
2 Get left edge of cellophane
3 Move edge of sheet up
4 Hold edge of sheet
5 Fold cellophane down
6 Hold edges of cellophane down on candy until sealed
Release sheets
7
8 Idle
9 Fold cellophane over end of bar
10 Hold folded cellophane down on candy until sealed
Release end of bar
11
12 Idle
13 Smooth out wrinkled edges
14 Fold cellophane over end of bar
15 Hold folded cellophane down on candy until sealed
16 Idle
Get next bar of candy 1
Place bar on cellophane 2
Get right edge of cellophane 3
Fold edge of cellophane down on candy 4
Hold cellophane down 5
Get piece of Scotch tape 6
Place tape across edges of cellophane 7
Get right edge of candy 8
Set bar on end 9
10
Get piece of Scotch tape 11
Place tape across edges of cellophane 12
Get bar 13
Turn bar end for end 14
Hold bar upright 15
16
Get piece of Scotch tape 17
Place tape across edges of cellophane 18
Get bar for disposal 19
Dispose of wrapped bar into carton 20

Motion Time Analysis

OLD METHOD

ONLY 22 per cent of total time for left side is shown as effective time. In other words, no useful work was accomplished by left hand during 78 per cent of total time required for operation. Percentage of effective time shown on right side is 73 per cent. This would indicate a poorly balanced operation with ample opportunity for improvement.

An analysis of ineffective time for the right hand showed:

1 Difficult grasp due to bars having been stacked cross-wise and close together.

2 Placing edge of bar parallel to a line printed on the cellophane. See if guides can be provided so that candy can be moved directly to correct position.

3 Difficult grasp, edges of cellophane sheets stuck together, not fanned.

5 Hold. All ineffective time as no useful work is accomplished.

6 Difficult grasp.

8 Difficult grasp. A slot in table to permit fingers to move directly under candy for grasping is one way to eliminate this ineffective time.

10 & 16. This item of ineffective time (0.0025 minute) is too small to justify trying to eliminate.

15 Hold.

20 Ineffective time is due to locating bar in final position in carton.

LEFT HAND

1, 8, 12, & 16. Idle time; 24 per cent of total time for left hand.

4, 6, 10, & 15. Hold; 45 per cent of total time for left hand.

2 Same as 3 on right side.

13 Smooth out wrinkled edges of sheet that was crumpled when bar placed on end for folding cellophane over upper end and sealed with a piece of Scotch tape. An ideal motion combination would accomplish this operation in half the time taken.

No useful work is accomplished during three-fourths of the time on the left side and one-fourth of the time on the right side, or approximately one-half of the time for both hands.

To improve this operation we must balance the various items so as to eliminate the large amount of idle time and hold on the left side; also eliminate standing bar on end and wrinkling unfolded cellophane.

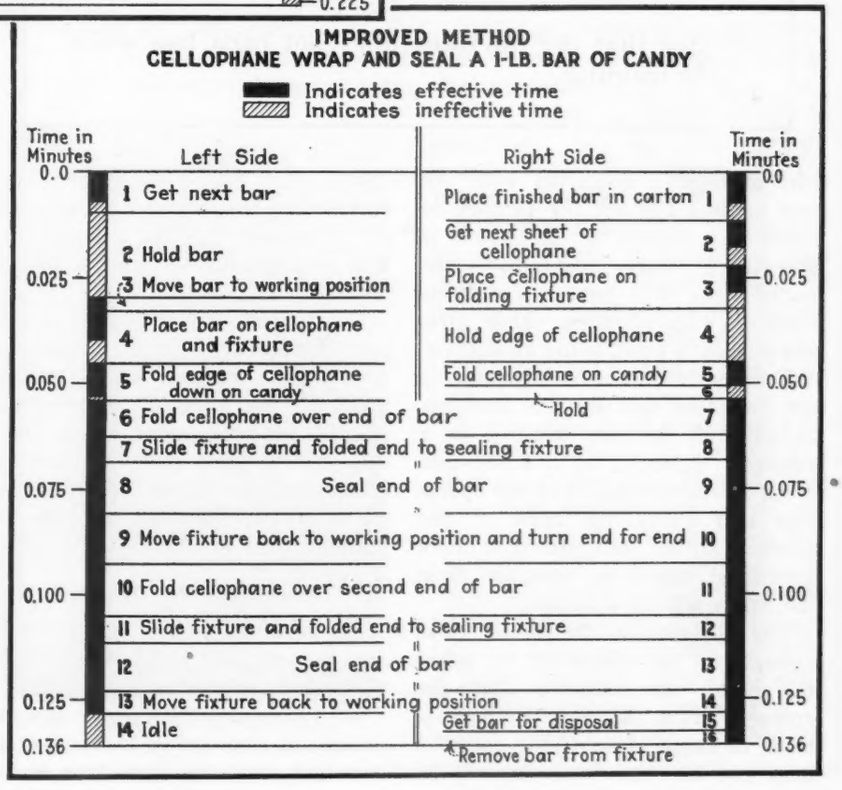
Difficult grasps seem to be the largest source of ineffective time for right hand. Guides to assist in locating would also reduce ineffective time.

NEW METHOD

Improved method is plotted on chart to same scale as method before study. Time has been reduced 40 per cent.

At time of study we did not find a practical way to eliminate all inefficient time in improved method. Further improvements may be worked out later.

Difficult grasps in method before study eliminated in improved method.



ators who were afraid to speed up on the new method because of these criticisms. Under this condition the first operator welcomes any excuse for believing that the new method is not practical and frequently magnifies small difficulties that could be overcome.

The management and the engineers usually do not realize the volume of criticism that exists when the first operator is being trained. The disagreeable remarks of the other operators often cause the first girl to become disgusted with the new method and not try as hard to make it a success as she would if everything were pleasant. She realizes she will have to continue working with all these other girls and wishes to avoid being an outcast.

Frequently this first operator is not convinced that she has anything to gain if the new method is a success. Selection of a supervisor or an instructor skilled in the operation and above the rank of the average worker will generally prove successful where an operator from the ranks will be a failure.

The foreman is frequently close enough to the operators to select the right one and see that she succeeds with the new method—if he is in favor of it. If the foreman does not like the improvement, its chances of success are about half what they would be if he were in favor of the improved method. The foreman must believe that he is going to benefit by its installation.

Why shouldn't the foreman be in favor of the improvement? It will reduce costs in his department. Ten to one the foreman had the same idea or some other idea which he thinks is just as good but never has had the time or specialized skill to develop. Now the production engineer comes along and makes this change and gets all the credit, so why should the foreman bother with it? No doubt it has already cost him lost production and a lot of bother.

The easiest way to install an improved method is first to make a very careful analysis of the present method, determine the waste and possible improvements; next to show the present method in chart form indicating the waste or inefficient parts of the operation in red, the efficient time in black.

Analyze the Old Operation

An accurate method of determining the efficient time and waste is that used in motion time analysis. This system analyzes every motion, assigns a time value to it, and determines what the ideal time would be for accomplishing it. Although this method reveals many small items of waste that are generally overlooked, any method of study that will show the items of waste or inefficient effort may be used to an advantage.

Now show the chart to the foreman who may offer some suggestions for improvement. They may be of little value, but must not be treated lightly.

Next, write a report. Usually a copy of the chart is included with an explanation of the losses shown. The management can see the losses in the operation, and when shown in this form it would not expect the foreman to have realized that these losses existed. But when the management is merely told of the losses it wonders why the foreman did not see them and try to eliminate them before the production engineer studied the operation.

Give the Foreman Credit

It is good practice to state that the foreman has made some very good suggestions for eliminating the losses in the operation, being careful not to indicate the exact nature of the suggestion until it has proved a success as the foreman may think that it is a plan to place the blame upon him if it does not work.

Show a copy of this report to the foreman before it is given to the management. Tell him you want him to look it over to see that there is nothing in it that will hurt him. He reads the report and sees that he has been given credit for good suggestions which he may know were not worth much, but he decides that if he is going to get some credit he can afford to think about the operation and its faults. Frequently the foreman thinks of something in a day or so that is worth while and proceeds to give the engineer considerable information about the operation and things that have been tried and why they failed.

If the foreman does not think of the best improvement, a few hints or questions will generally cause him to say enough so that he can be given credit for the improvement if it is successful. With the foreman enthused about the improved method, three-fourths of your training difficulties are over.

To Train First Operator Successfully

1. **Analyze present method.**
2. **Make improved method the best you can.**
3. **Write down standard procedure.**
4. **Sell the foreman.**
5. **Give him credit for suggestions.**
6. **Select an operator who will not be influenced by criticisms of others, one whose prestige will not be endangered.**
7. **See that the operator does not earn less while in training.**

A Pay Check Every Week

For employees, security. For management, a compelling incentive to level out its production peaks and valleys

An interview with
HENRY L. NUNN
President, Nunn-Bush Shoe Company
Milwaukee

SO MUCH of employer-employee thinking is unsound because it starts off on unsound premises. One of these fallacies is the idea that it is entirely all right for the employer to fluctuate his employment in accordance with the orders on hand. Another is that the important consideration to the employee is the hourly rate, or the per piece rate. The employee cannot live by the hour or by the piece. He and his family must live by the year.

Thus it devolves upon the employer who desires his people's loyalty to provide employment more stable than is generally considered entirely permissible. Likewise it is better that he should pay them a fair annual income than that either he or they should be concerned about an hourly or piece rate.

To us it has for some time seemed plain that a mutually equitable, and mutually advantageous, policy must be built around some plan that would make labor an integral part of the business organization, with the same mutual interest in the sales of the products as has the management. This could not be the straight hourly wage plan, with the employer reserving the right to lay off men at will. It could not be straight piece rates.

Something Else Needed

Hourly wages are the better of the two, since thereby the employee is guaranteed a definite amount of money in weeks when work is available, and likewise since the employer who pays by the hour is penalized in less efficient production whenever he lays off or hires.

Straight piece rates are highly undesirable from the management's standpoint, if the subject is thought through, because it is practically guaranteed an unfluctuating labor cost per unit, and is thereby deprived of the principal incentive to level the peaks and valleys of its production schedule.

We set about developing some sort of plan that would get round the difficulties outlined above. We wanted a plan that would assure employment and steady income for the employees, provide a management incentive to level our production, offer the employees a genuine incentive to make savings in manufacture. Now we have just such a plan, jointly developed by the shop union and the management, and it shows every prospect of working out to the advantage of everybody concerned.

Here Is Our Plan

Our plan embodies several ideas that are, as far as we know, previously untried in industry, though some of them have been rather closely approached:

1. Every employee now in the plant is put on an annual salary that guarantees him 52 weekly pay checks during the year; as will be explained, we do not actually guarantee him a specific sum for the full year's employment.

2. These salaries are paid out of an appropriation budgeted for labor cost, and any savings effected whether by management or employee initiative are credited to a fund that is to be divided among all employees as a dividend.

3. The employee's weekly salary is figured by dividing 52 into his previous earnings in the 48 weeks that have been our average year's employment in the factory, and any employee who works more than 48 weeks during the year, or who works longer than normal hours, is paid for this additional time.

Most important provision, after the straightforward guaranty of 52 weekly checks, is the method by which the wage fund is set up.

As it happens, for many years

Signing the contract which guarantees to 700 workers of the Nunn-Bush Shoe Company 52 salary checks a year. In the center, Mr. Nunn, president of the company; left, a member of the bargaining committee of the shop union; right, the president of the shop union

now, when shoes were high priced and when they were low priced, our labor costs have run at almost uniformly the same percentage of our gross sales income—this has varied only about 2 cents on the dollar. It is therefore mutually agreed between employees and management that this figure (for convenience we have taken the nearest round figure above this average cost) is normal for our business. At any time, this percentage applied to the company's gross sales constitutes the proper labor budget for the year thus far.

In arriving at the yearly salary to start our plan on last July fourth, we estimated that we shall run 1,920 hours during the year. Figured on a basis of 40 hours to the week, taking out legal holidays and customary vacation, there are only 1,976 hours available.

Salaries and Sales

The yearly salary is based upon the 1,920 hours at the present hourly rate; our company has never operated on a piece rate basis. This salary is set up, however, with the understanding that, if for any reason we run more than 1,920 hours, the employees will be paid for the additional hours worked and, at the same time, if the employee is absent from work when work is available, the number of hours he has failed to put in will be deducted.

After arriving at the amount of yearly salary, we pay this sum in 52 weekly payments. And this amount will not be less, regardless of how many hours we work, unless labor cost should rise. If the cost per dollar of sales should rise 2½ per cent, as will be presently explained, we reserve the right to reduce weekly salaries to bring the cost back into line.

If it happens that the number of dollars paid out in salaries to factory employees during a year is less than the percentage thus budgeted for labor, the difference or saving is split up among the factory employees as their dividend. Thus, plainly, as prices rise the workers' compensation will automatically rise. As prices fall it will be reduced. There

will be under this plan no need for the ordinary type of wage adjustments. The adjustments take care of themselves.

Our plan is not to be confused—as many newspapers confused it when first announced — with any form of profit-sharing. It is distinctly not profit-sharing. Rather, we start out the year's salary scale on the assumption that our sales will be equivalent to the sales of previous years, in dollars. If we do not manage to take in so many dollars, then we shall have to reduce salaries to keep them in adjustment to the agreed-upon percentage of sales. (It is not contemplated by the management, of course, that the employees will have to accept less than the amount we have estimated at the start of the year and which we are paying them in 52 equal payments. But there does exist the bare possibility that reductions might have to be asked for.)

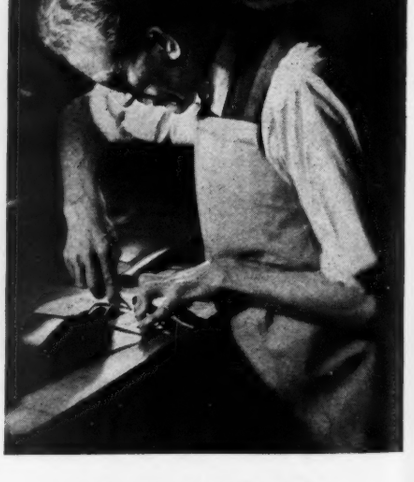
If we do reach sales figures that give this labor budget when multiplied by the agreed-upon percentage and surpass it, the employees are guaranteed, and are guaranteeing, that labor cost on the year's sales will be precisely this percentage. The company cannot make a profit on the employees by speeding them up or saving labor by machinery, and the employees have an opportunity to increase annual incomes if the sales department sells more shoes and the same old number of employees manages to turn them out.

Of course we could not enter into such an undertaking without some safeguard against a continuing loss under it. This safeguard is in the form of a provision that whenever the direct labor cost per dollar exceeds the normal by 2½ per cent, the management may at its discretion cut salaries to a degree that will take up the slack.

Pulling Together

Our employees thoroughly understand, after years of more than normally close and friendly relations, that they must help us turn out a product that can be sold in competition with others, else their jobs cannot continue because we would be put out of business. So we anticipate no difficulty if such a salary cut should ever be necessary. It will be just as much to the interest of the workers that the management refrain from asking too high a price for its product as it will be to the management's interest. It will also be just as much to the workers' interest that prices be reduced, when justified.

(Continued on advertising page 48)



Power Is Canned Labor

It's costly, forms an integral portion of every manufactured product, deserves more attention than management has been accustomed to give it

JAMES O. G. GIBBONS
Consulting Engineer, Bloomfield, N. J.

POWER is as much an integral part of a manufactured product as material or labor. It is really a form of concentrated labor—canned labor if you care to think of it that way.

From a management point of view, this is important. Too often power is looked upon as something apart from manufacturing; as something like taxes, a necessary evil to be thought about as little as possible so long as the cost does not appear to be unduly excessive. This is not true of the labor and materials that enter into the finished product.

True, the economical production of power is a highly technical matter. Financial and other executives cannot, in many cases, reasonably be expected to be power plant specialists. Nevertheless, there is no reason why some of them should not be qualified to make an intelligent analysis of the power plant records, provided these records are expressed in familiar terms.

In a large organization a qualified professional engineer may, of course, be employed to supervise the production, distribution, and economical use of power, but how often are his recommendations and reports treated with the same consideration as those of the accountant or purchasing agent?

On Deaf Ears

If the price of raw material is too high, or the quality is not satisfactory, management immediately seeks a remedy. However, if the power plant engineer reports that steam costs are too high, or that he lacks proper equipment to check the efficiency of his plant, his complaint too often falls upon deaf ears.

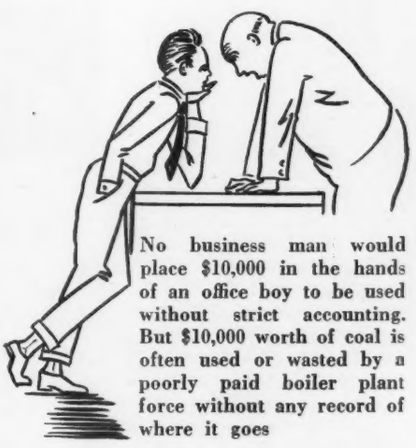
The engineer is somewhat to blame for this condition; too often he places a smokescreen of mystery around his job. He will not, or does not, analyze his problems in terms of dollars and cents, say, instead of British thermal units or kilowatts.

On the other hand there is no more mystery about B.t.u.'s and kilowatts than there is about the percentage of pigment and vehicle in a gallon of paint. One does not have to be an engineer or chemist to understand these things when they are explained in an understandable manner.

A Production Problem

The production department has the problem of converting the least possible amount of material and labor into the largest possible amount of finished goods of satisfactory quality. The problem of the boiler and power plant is to convert the heat in the fuel into forms that can be used in the factory, so as to give the best possible service at the least possible cost. Hence, it is a part of the production problem—not something that can be treated as being apart from it.

To buy fuel means to buy energy. The power plant does not make energy; it converts it into usable form. We want the energy in the fuel to be of such a form that it can be be gotten out at the least possible expense.



No business man would place $10,000 in the hands of an office boy to be used without strict accounting. But $10,000 worth of coal is often used or wasted by a poorly paid boiler plant force without any record of where it goes

It should be the business of the management to know exactly how much steam can be obtained from a dollar's worth of coal, and how much power can be obtained from a dollar's worth of steam. In addition, it is necessary to know the labor and overhead costs.

In order to keep track of the power plant costs and efficiency of operation, it is necessary to establish a suitable accounting system and install the instruments required to furnish the data upon which to base calculations.

It is necessary to know what goes into the plant, what comes out. The things that go into it are fuel, labor, incidentals such as water, and oil, and the upkeep of the equipment; the things that come out are heat and power.

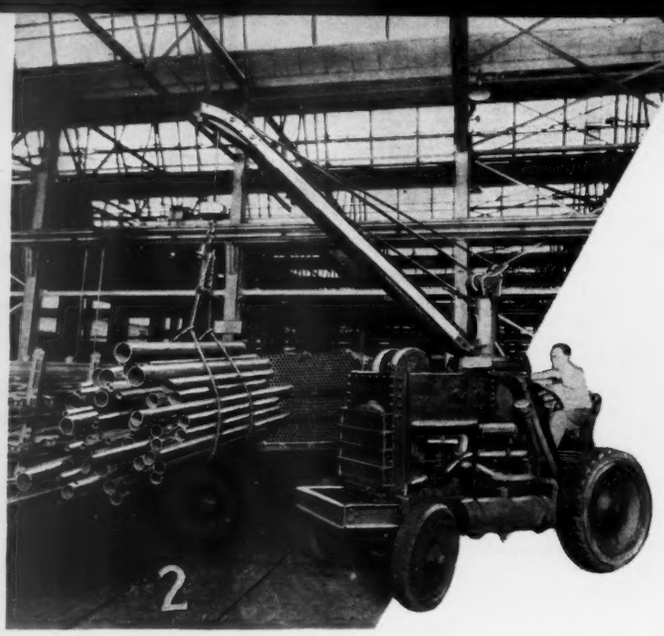
All these things, possibly excepting depreciation of equipment, which may be treated as a capital charge, can be measured with considerable accuracy if the necessary instruments are installed and records kept.

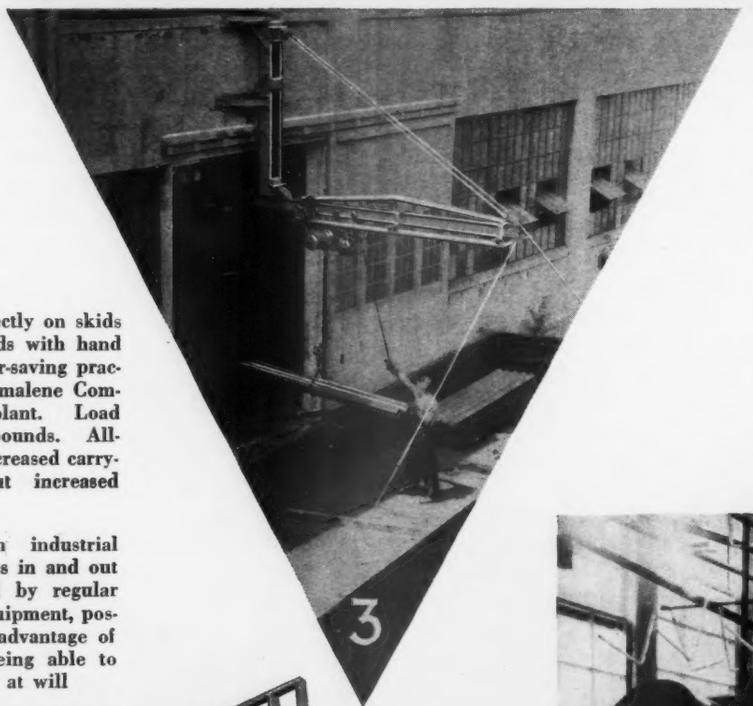
Say It in Dollars

There is no reason why the results should not be reported to management in terms of dollars and cents, pounds of steam, or kilowatts of electricity. Eventually, they may even be expressed in units of factory output, their logical destination.

No business man would think of placing $10,000 in cash in the hands of one of the office force, to be used at his own discretion, without a strict accounting. But it is not uncommon for $10,000 worth of coal to be placed during the year in the hands of a poorly paid boiler plant operating force to be used, or wasted, without any means of keeping an accurate record of where it goes or how much power it produces.

These conditions are inevitably reflected in unnecessarily high production costs.





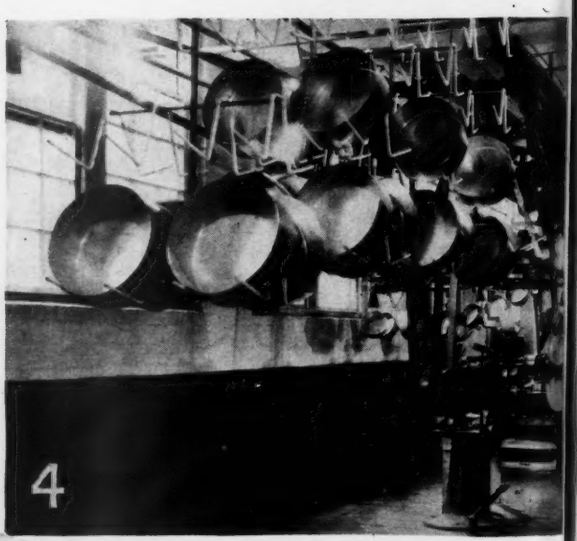
WHAT

It's hard tions that

1 Warehousing directly on skids and moving unit loads with hand lift trucks is the labor-saving practice in use at the Climalene Company's Cincinnati plant. Load here weighs 3,900 pounds. All-welded skid means increased carrying capacity without increased weight

2 Mounted on an industrial tractor, this crane goes in and out of places not served by regular overhead handling equipment, possesses the additional advantage of complete mobility, being able to move from job to job at will

3 Monorail at Globe Machine & Supply Company, Philadelphia, extends by means of jib crane over railroad car, provides quick, economical unloading and moving to storage



4 Bottoms up! They're teakettle bottoms riding an overhead chain conveyor at the Revere Brass & Copper Company's plant in Rome, N. Y. Note the special fixtures designed to carry the bottoms in squads of four

5 Pallet boards and tiering trucks are popular around plants that have to use that storage space up next to the ceiling. Those cartons are full of glass

6 Industrial railroading with track-type tractor for a locomotive. It's hauling a heavy train of castings from foundry to machine shop. Rubber shoes go easy on the floors

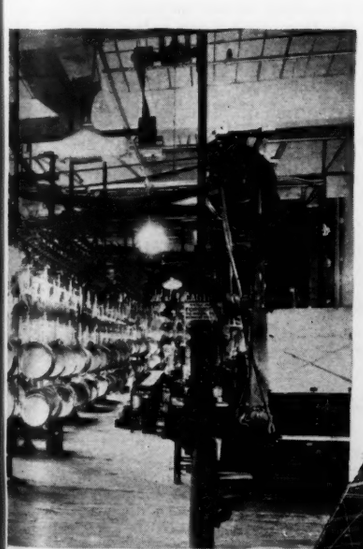
DO YOU HAVE TO HANDLE?

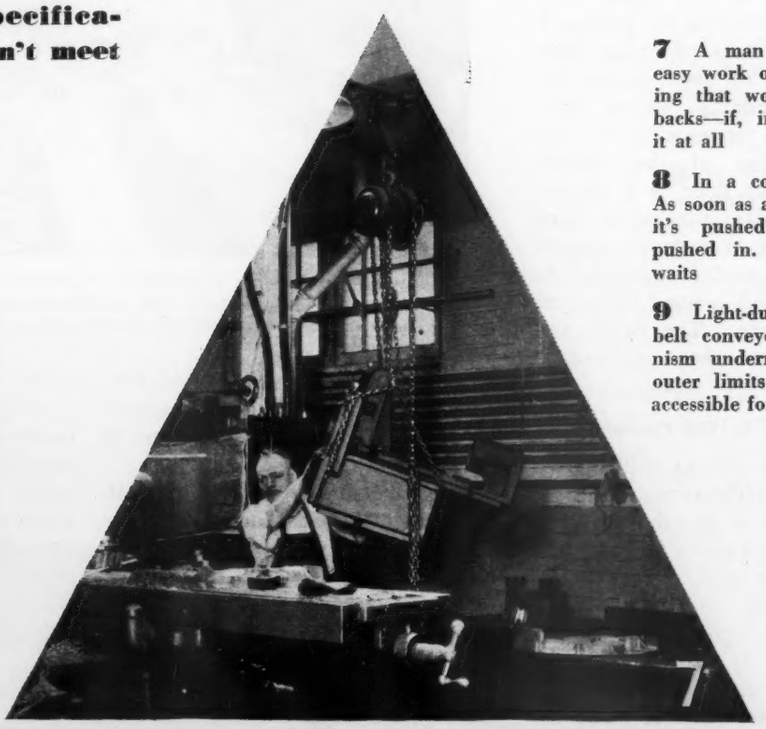
to write handling specifications modern equipment can't meet

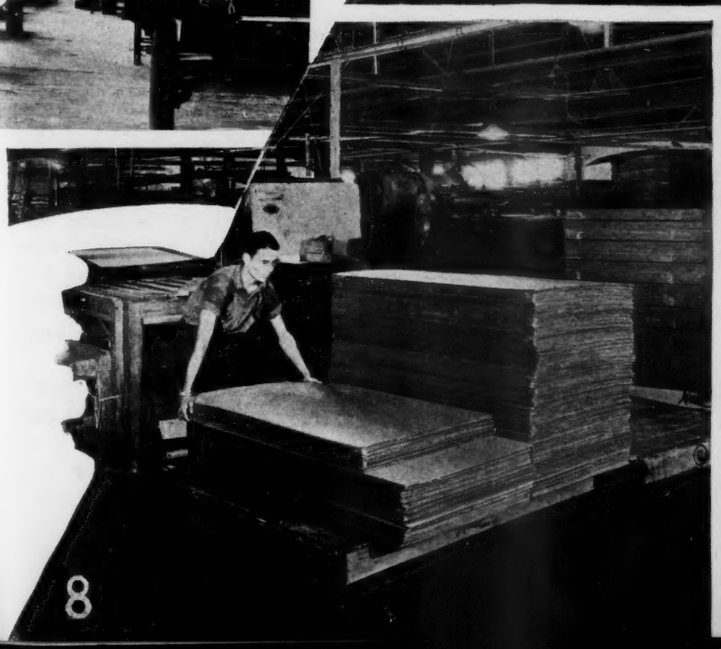
7 A man and his hoist make easy work of lifting a heavy casting that would break two men's backs—if, indeed they could lift it at all

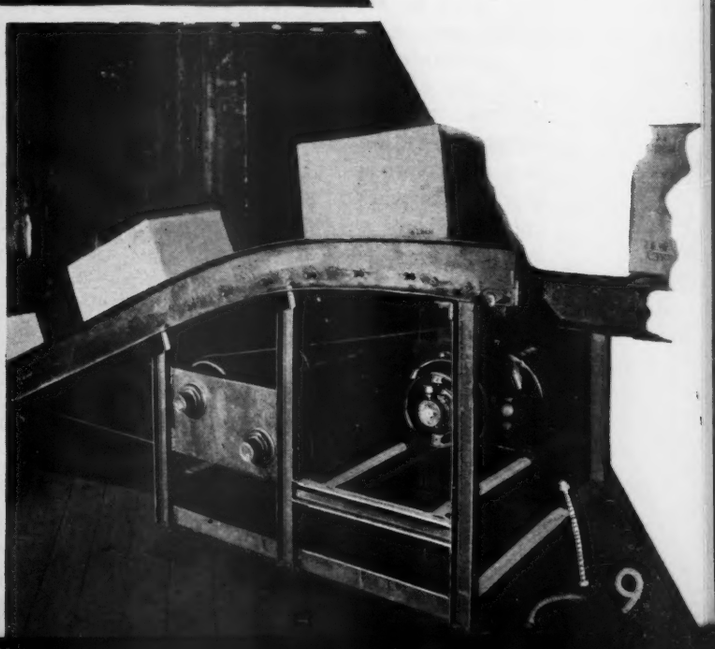
8 In a corrugated box factory. As soon as a floor truck is loaded, it's pushed out and another's pushed in. The machine never waits

9 Light-duty package handling belt conveyor with drive mechanism underneath and within the outer limits of the frame, easily accessible for maintenance









Where the $400,000 Went

Part 2 of a yarn about the plunge (see July, page 278) that Morrell took — toward everlasting profit

GEORGE M. FOSTER
Vice-President, John Morrell & Company
Ottumwa, Iowa

OUR HOG-CUTTING building, erected in the dark days of 1933 at a cost of $400,000, operates on the principle that the easiest and cheapest way to move materials is usually by gravity.

(Editorial note. A blueprint of the cutting floor, reproduced in last month's article—July, page 278—will help the reader follow Mr. Foster's description of the process.)

We walk the hogs up under their own power and kill them on the top floor of one building, whence they travel by chain conveyor to the top, or seventh, floor of the cutting house. This top floor is a section all to itself. Its interior is hard brick. Its roof is a double-glassed skylight. The roof is insulated to keep it cool. All around the room are cooling units. The floors and lower sections of the walls are of smooth tile, easy to clean.

Hog cutting is mainly disassembly. Carcasses start at the raised table at the far end. Hams, middles, and shoulders go their separate conveyor ways. A chute at each work station drops trimmings to the trimming floor below

From Chain to Slat Conveyor

When the hog carcass, chilled from its night in a refrigerator, enters on chain conveyor, it is unhooked at a table about 6 feet above the floor and at the extreme end of the room. This table has wooden surfaces about two feet wide at the edges. Wood, after all, is the best available surface on which to wield a knife that must be kept sharp. But the middle section of the table consists of a galvanized-iron slat conveyor.

At the sides of the table stand workmen ready to perform the successive operations in taking a carcass apart into useful cuts of meat. Most of the work is performed with knives. When a sawing operations is required, either a bandsaw is built into the table or, as occurs a good many feet further along, circular saws are available. At this first table, six feet or so above the floor, carcasses are divided into three major sections—hams, shoulders, middles. The table is about 40 feet long, and by the time the carcass has traversed this short distance, it is ready for further subdivision.

Hams are slid off this conveyor to another which leads down the right-hand side of the room. Shoulders are slid onto one which leads down the left-hand side. The middles, when they come to the end of the conveyor, slide down a little incline to another similar table. Incidentally, packing house experience with slat conveyors has developed a standard method of transferring work from one such conveyor to another. The second conveyor is 6 or 8 inches lower than the first, and an apron receives the load at the end of the first conveyor and slides it down to the next, thus avoiding either pile-ups or human handling.

There is no point to detailing how the pork progresses step by step, table by table. There are several conveyors, each at a lower level than its predecessor, along each of the three main tables. These conveyors differ according to the jobs they perform. Some of the slats have hooks to hold the meat. One section has the slats grooved across—which is longitudinally of the conveyor—to permit circular saws to cut through passing sections of meat. Some are wide, others narrow. Some are slow moving; others are speeded up. It all depends on the task.

Kept Clean with a Hose

At each workman's station there are two other standard pieces of equipment, however. One is a chute, leading to the floor below, which receives his trimmings. The other is a small box full of water, into which a small steam line escapes enough steam to keep the water hot. Into this hot water the cutter plunges his knife every cut or two, thus preventing the fat from building up a thick coating on the knife and hindering his work.

The room is so constructed that it is extremely easy to clean. The only

tool needed, after the day's work is done and the room emptied of all meat, is a hot-water hose. The lower walls, floors, tables, chutes, and all other equipment are flushed off. The room dries clean, free from grease.

There are around our plant a number of other equipment installations of recent date. For example, there is the set of smoke-houses, each what is called the revolving type, but called so inaccurately because the house does not revolve, the contents merely move around. The hams, bacons, picnics, or other pieces to be smoked are hung on hooks on chain conveyors. These conveyors move over sprockets which lead a given piece of meat up and down, forward and back. The individual ham starts at the bottom at the extreme rear, and progresses forward, moving up to the top of the house and down to the bottom again for each sprocket width traversed forward.

By the time the lot has been in the smokehouse for the proper time at the proper temperature, every piece has been smoked exactly like every other. Uniformity of cure and of smoking is a secret of pleasing customers for such meats. Pleased customers lead to increased sales.

But you get the idea perfectly. There is no need to amplify it further. The point is, if it pays to keep your plant up to date and your costs down to minimum in good times, it is a great deal more important to do it in times when profits come hard. For profits, after all, are compounded of dozens of factors, from buying the raw material and moving it through all the manufacturing processes and selling until finally the money is collected and banked. And unless a manufacturer keeps his plant up to scratch, he is surely not equipped to earn the profits he might by holding the plant to more exacting standards.

Laid Out Like a City

Numbered streets and lettered avenues speed selection of parts for assembly, replacements for branches or customers

J. F. ANDREWS
Editorial Department

SPEED in selecting stores items depends to a large extent on arrangement of racks and method of identifying location of stores items. In the Aurora, Illinois, plant of the Independent Pneumatic Tool Company, the rows of steel shelving are laid out like a model city with streets (aisles) numbered consecutively and with the avenues (cross aisles) crossing the streets identified by letters.

Each section of the various aisles may therefore be likened to a city block with the bin numbers corresponding to house numbers. Sections cut off by a lettered aisle are devoted to a particular product thus: All the parts stored in *A* sections are used in pneumatic hammers; *B* sections and part of *C* store parts for air drills.

At the end of each row of racks, facing a lettered avenue, is a single rack containing adjustable steel compartment boxes for the accessible storage of small items. All parts are kept in numerical order regardless of size or weight, from a few pounds of rubber washers to as much as 3,700 pounds of steel drills on a single shelf.

The key or directory is a master stores board at one end of the storeroom. Here charts list the 18,000 parts stored and show exact location by aisle, rack, and bin.

Perpetual inventory records are kept in the storekeeper's office on visible index cards. As a check a continuous physical count is taken, item by item. The colors of the stores records have special significance. A manila card indicates a standard item; white, semi-obsolete parts; blue, obsolete parts. For work-in-process records a pink sheet is placed over the index card so that the storekeeper knows exactly when the supply of that particular item will be replenished.

Orders are received either from the assembly department or from a branch or customer. These are turned over to an order picker who takes his truck together with a steel tote box for each part and goes up and down the aisle assembling the items. Tote boxes for the assembly department are carried there on a roller conveyor. Manila envelopes are used for small replacement parts going to customers or branches.

Photograph by Rittase, courtesy of the Sherwin-Williams Company

Automaticity—fullest use of technological development—holds down the price of bread in spite of process tax. Illustration from the Williams Bakery, Wilkes-Barre, Pa., where 11 men operate the plant and output is 2,000 loaves per hour

Cost per Task

Will make it easier to keep other expenses in line with direct labor

PHILIP BERNSTEIN
Time Study Engineer and Job Analyst
Winchester Repeating Arms Company, New Haven

LET'S define a task as the quantity of direct labor in one standard man hour, or, if it is piecework, the amount of work that will earn 50c. for a male and 35c. for a female operative.

Now all costs can be reduced to costs per task, such as direct labor, material, repairs, tools, scrap, and even fixed expense per task. For example, if the piece rate for a certain operation is 1c. per M, then the task is 50c. divided by 1c., or 50 M. Now, if there were 10 such operatives, each performing 8 tasks in 8 hours, the direct labor cost would be $40. Number of tasks would be 10x8 or 80, and cost per task would be $40 ÷ 80 or 50 cents.

Cutting Rates

There is now a movement back to daywork in the automobile plants, and probably the dissatisfaction of labor under the old plan had something to do with the shift. Suppose, in the above example, each of the 10 operatives could perform 10 instead of 8 tasks in 8 hours. Hourly earnings would increase 25 per cent although direct labor cost per task remained constant. Immediately some supervisor seizes upon the chance to effect a slight change in the operation and reduce the piece rate about 20 per cent, so that hourly earnings return to 50c. again.

Now it is possible that the operatives can call upon their ingenuity and reserve and still turn out more than 10 tasks, but will they? Not on your life. By the grapevine route the whole plant hears of the rate cut. Everyone is told not to kill the job for someone else, and shop morale is broken for a long time to come.

A specific example will show how nearsighted management is to cut rates because of high earnings.

Take the same 10 operatives each performing 8 tasks in the first instance and 10 in the second, a total of 80 tasks compared with 100. The table shows costs per task.

By allowing earnings to increase directly with increased output or tasks, the company has reduced total cost from $1.175 to $1.04 per task, 11½ per cent, instead of 20 per cent if they had reduced the piece rate also. The 20 per cent is a bigger gain, but it won't happen a second or third time, and future savings are retarded or killed.

The difficulty today is to keep other expenses in line with direct labor. As soon as a reduced schedule appears, direct labor decreases, but indirect lags.

Indirect Costs per Task

With cost per task, however, obtained daily or weekly, the indirect per task is known immediately and should remain at the same value as when the plant was operating at greater capacity. For instance, say the indirect cost per task is 30c. when activity is at 80 per cent capacity. Now when activity has dropped to 60 per cent and indirect has risen to 40c., we know at a glance that we must reduce our indirect 25 per cent to keep it at 30 cents. This does not necessarily mean 25 per cent of the indirect help must be laid off. They can spend 25 per cent of their time on direct labor and 75 per cent on indirect. The same is true of all other controllable expenses.

For estimating purposes and budgeting, we can now figure how many tasks there are in a gun, a pocket knife, an automobile, etc. Then, when we know what our schedule is to be, we can multiply output by number of tasks per unit of product and then by cost per task to find what expenditures will be paid out. The same holds true for material.

Bonus for Indirect Workers

For non-productive departments, expenses should be divided by number of tasks in a division or the whole plant, depending on whether the shop concerned services a division or the entire plant. The cost per task for these particular shops will fluctuate violently, if the plant activity goes from a peak to a trough and back again to a peak in a complete cycle. To keep cost per task at its peak activity value, will require able and alert supervision to take up the lag. However, where repairs to machinery are undertaken during low activity, this one item will have a high cost per task, and a correspondingly low value during high activity.

To lower costs, there is no method better than an incentive or bonus for key indirect workers, based on cost per task, for the various accounts that these men may wholly or partially control.

These accounts are those like direct labor, indirect labor, scrap, tools, supplies, repairs, etc. The budget can be set up, say, from actual cost per task for the last four weeks. Now a 50 per cent bonus can be paid for the difference between actual cost per task for any week and budget, in

Cost per Task

Items	*80 Tasks*		*100 Tasks*	
	Cost	*Cost per Task*	*Cost*	*Cost per Task*
Direct Labor	$40	$0.500	$50	$0.50
Indirect Labor	30	0.375	30	0.30
Tools	20	0.250	20	0.20
Scrap	4	0.050	4	0.04
Total	$94	$1.175	$104	$1.04

proportion to the weekly earnings of the men. It should be cumulative, wiping out any previous deficit before paying a bonus. Then to take care of the improvements the management would ordinarily make, a revision in the budget should be made to a point halfway between the cumulative actual cost per task and the budget, after $1,000 of bonus has been paid.

Like an arithmetical progression, the next revision in the budget would be made after an additional $2,000 has been paid, and still again after an additional $3,000 has been paid. The reason for these longer periods before revision is that it becomes more difficult for the men to earn bonus as the budget becomes lower.

The Task Never Changes

Once a task is set as of a certain date, this task is never changed, i.e., for obtaining cost per task. For instance, suppose there are two operations, *A* and *B*. The task on *A* is 2,500; for *B*, 2,000. Say an operator can do 8 tasks in 8 hours on either *A* or *B*. Now, suppose *B* has been eliminated. In order to credit the shop for making as many units as before, we credit *A* now with as many tasks as both *A* and *B* had. In other words, output on operation *A* is now divided by 2,500 and also by 2,000, and the sum of these quotients is the number of tasks performed on *A*, which is equal to what would have been performed on *A* and *B*, if the latter had not been discontinued.

However, to avoid forgetting this, task for *A* can be revised to 1,110, instead of 2,500, which is really not changing the task but is a shortcut in the clerical work. On the other hand, if an operation, say *C*, is added to the process, no tasks will be credited to *C*, because it was not in existence at the original task set-up time, and the shop must show the increase in cost per task in direct labor, adding dollars to the numerator of the fraction and no tasks to the denominator. The above must be done in order to get a comparison of present cost per task with any previous week.

In the same way, where a reduction or increase in the labor cost of an operation takes place, the task remains the same as originally, benefiting or penalizing the shop in question from a cost standpoint.

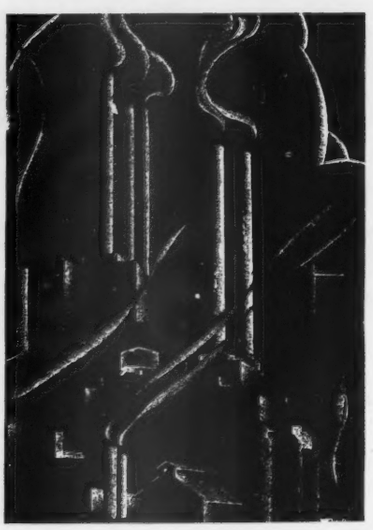
The benefits of such a cost plan are numerous. Once a unit of product has been tasked, the shop receives credit for that number of tasks per unit, irrespective of whether 20 operations are being performed as at the start or 5 as at the present time. In other words, even though man hours to produce a unit have been reduced 75 per cent, tasks remain constant, but cost per task gives the true picture of savings.

Better Than a Raise

Another invaluable aid is the fact that each item of expense is broken down into cost per task, and it enables able supervision to keep these values nearly constant with peak activity values or immediately know why.

With this cost plan, a foreman or key man need never hound his superiors for a raise. His cost per task speaks for itself. If said cost has increased, he hasn't a leg to stand on. For key men, a bonus is better than a raise from a management standpoint, because the indirect costs are not raised at one time and then reduced during slack times, causing hard feelings, which the management can't help, because the raises have brought indirect costs out of line. With a bonus, however, if cost per task rises, no bonus is paid.

For the executive who hasn't the time to go into all the details, a cost-per-task index number can be figured each week for any certain shop, based on 100 as cost per task of the first week. For instance, cost per task for direct and controllable might be 73c. for the first week. It might be 72, 68, 69, and 65c. for the four following weeks. Adopting the 73c. as 100, the four following weeks would be 98½, 93, 94½, and 89, showing the executive that all was well, as the cost trend was favorable.



As a means of comparing two plants in the same industry, the task plan is valuable in finding out which plant has more tasks per unit of product and consequently which has the lower cost per task, the ultimate goal. Cost per task for each item of expense will point out clearly where one plant is more efficient than another.

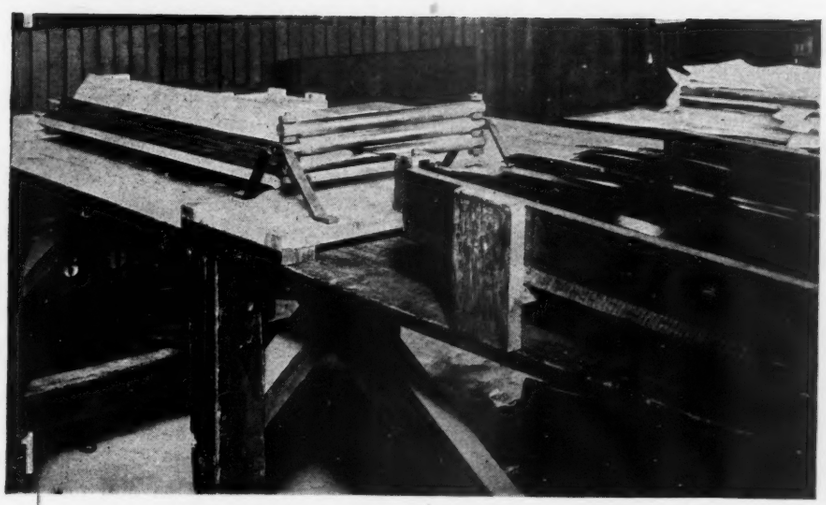
Guaranteed day rate has turned the spotlight on piece rates, inefficient operatives, and supervision. Let's say the day rate is 35c. for female help and 40c. for male. Now suppose direct labor cost per task is 38c. and guaranteed day work cost per task is 12c. Then the average foreman, when pressed as to the reason for the 12c., says the piece rates are low, and, lacking incentive, the operatives will not make an effort. Therefore he would suggest raising rates about 30 per cent, so that direct labor cost per task would be 50c. while guaranteed day work cost dwindled to zero.

That is the easiest way out, also the costliest. It is necessary to assemble the brains of the plant, get new equipment, coach the operatives, eliminate the hopeless ones, and then, say, raise the rates in certain instances, so that direct labor cost may go up to about 42c. per task and guaranteed day work down to about 1c. per task, a saving of 7c. per task, or 14 per cent.

When to Reduce Piece Rates

I may previously have given the impression that piece rates should never be reduced. That is far from the truth. Take, for example, a girl who feeds a press by hand and whose task is 2,000. Then the management rigs up automatic feeds, so that the girl can now look after two presses and turn out 5,000 per hour. An adjustment in the piece rate must be made, and in this case the operative has no just cause for complaint, as her work has become less tiresome and requires less physical effort. At the same time the cost per task is lowered, because the shop is credited with 2½ tasks for every one formerly, and of course this affects every single item of expense.

A second article, scheduled for September, discusses cost per task as a wage payment plan.

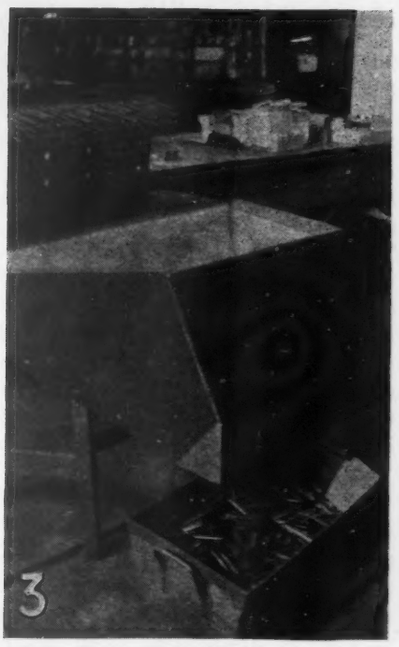


1 Inspecting strips of hard rubber. Strip is passed through a width gage into a pair of rollers to check maximum thickness, is then pre-positioned for packing. Old time cut in half by combining "get ready" and "clean up" on three operations into a single handling

Mind the Motion

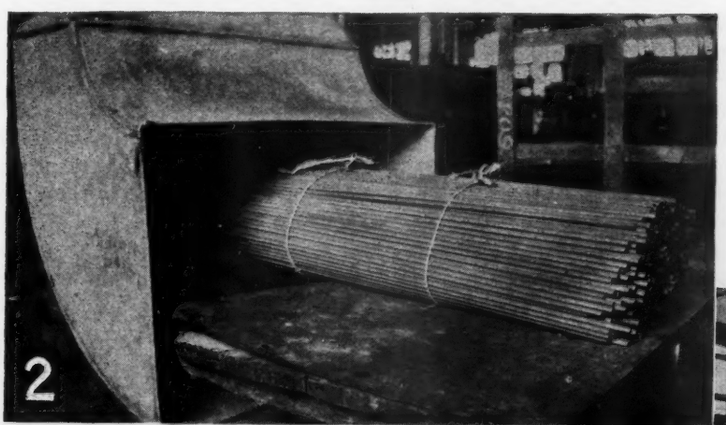
Five of the "littler" things in a motion-minded plant, add up to a not-so-little saving

WILLIAM R. MULLEE
Standards Department
American Hard Rubber Company, Butler, N. J.

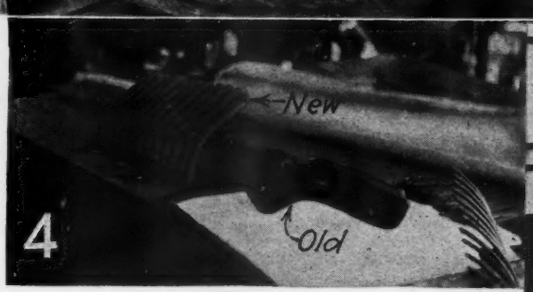


3 Drop delivery is found everywhere in the motion-economized plant. Here, a special workbench arranged to chute pieces from vulcanizer trays to waiting tote box

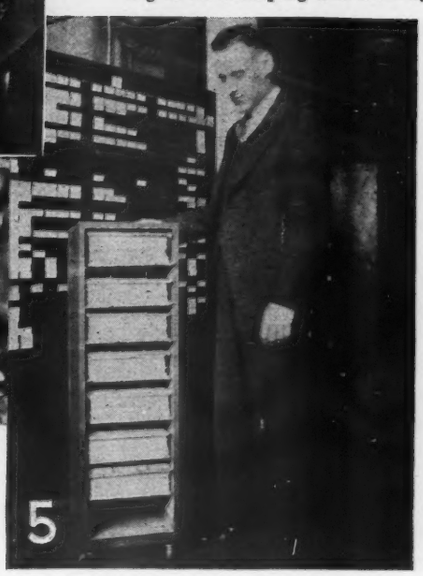
5 Even the office gets motion-minded, adopts trucks like this to simplify the job of moving current records from safekeeping to bookkeeping and back again



2 Multiple cleaning. After ends are ground, the bundle of tubes is wheeled on truck to exhaust hopper, and dust is blown out without unpacking and handling. Saves "get ready" and "clean up." Dust was formerly blown all over the room



4 Bending syringe pipes. Old cavity fixture applied bend externally. New fixture does the bending internally. Pipes are simply slipped on while warm. Two-handed loading possible. And there's a multi-stripping device. Old time, 0.145; new, 0.07. Saving, 52 per cent



We Centralized Typing

Ten years' experience has produced a uniformly high quality of work at a cost that is 60 per cent lower

MARY L. LITTLE
Supervisor, Bausch & Lomb Optical Company
Rochester, N. Y.

"CENTRALIZATION of function" has become a well-worn phrase in business offices during the past few years. Filing, typing, tabulating — in fact, almost any repetitious routine—lends itself to centralization. Perhaps the most applicable of office routines to centralization is the typing function. The production of typewritten material represents a fair share of our office expense budgets. The necessity for accuracy makes it one of the most important operations of clerical work. Its quality reflects the character of the organization and the product it markets.

High Quality at 60% Less

In the organization of our stenographic department, two definite objectives were laid down—standardization of quality and lowering of cost of production. Ten years' experience has produced a uniformly high quality of typing at 60 per cent lower cost.

Several distinct steps were taken in planning the department:

1. **We studied the market** for the service rendered by a stenographic department. Jobs that could be brought into a centralized department were analyzed. These are:

Dictating machines were found to be rapidly supplementing shorthand dictation. They have proved to be economical and efficient at Bausch & Lomb, were installed as part of the original equipment of the department, have contributed a major portion of the savings effected.

Form letters, copy jobs of all kinds, tabular work (figures and schedules), mimeograph stencils, and envelopes and fill-in jobs for processed letters come under the heading of general typing. All these jobs were centralized into the stenographic department.

Stenographers and typists are kept available to lend to other departments where a definite need has been established. It has been found desirable to minimize this service and bring into the stenographic department all work that can be transferred.

2. **Service.** Experience has taught us that the success or failure of a stenographic department depends upon its reputation for service.

All work received in the stenographic department before noon is performed and returned to the sender the same day.

Work received after noon is not promised for delivery the same day. This part of the schedule accomplishes two things; it encourages dictators to dictate in the morning, and insures a steady flow of work through the department.

Rush work is given preferential attention when the need for such service has been established.

A copy of the service schedule is placed in the hands of each person using the service of the stenographic department. Deviations are reported to those involved *before* they are made.

Department heads are encouraged to discuss with the stenographic department unusual jobs that are to be sent to the department for execution. Plans for advertising campaigns are laid weeks in advance of the release date, and copies are sent to all departments involved, including the stenographic department, so that steps can be taken to prepare for the job.

Scheduled Service

The service schedule includes the collection and delivery of work, shaving of dictaphone cylinders, and keeping the dictators supplied with fresh cylinders. Hourly collections and deliveries of work are made to all parts of the plant until 3 p.m., after which time quarter-hourly service is given until closing.

3. **Personnel.** The necessary personnel to maintain the required quality of production and meet the service schedule must be available. Satisfactory stenographic department operators must have a good educational background, be energetic and intelligent. The equivalent of a high school academic course and a business training course are recommended as educational background for any operator. The training which an operator receives in the stenographic department is of such a diversified nature — since all branches of the business are represented in the work performed there —that experienced operators are transferred from that department to important clerical and secretarial positions in other departments.

Stepping Stone

Salary rates in a stenographic department should be kept above those for general clerical workers, in order that transfers may be effected into the department as promotions from other clerical jobs, and transfers out of the department may be considered only as promotions.

New employees are brought into the training department, transferred into the stenographic department, and ultimately placed in other departments where such need arises. The result is that experienced workers are available for clerical positions, and the saving in time of supervisors or other employees in giving elementary instructions is well worth the effort expended in the training department.

4. **Bonus System.** A cooperative spirit among the workers is essential to the smooth operation of a stenographic department. A bonus system of payment for production

over a predetermined minimum is a means towards promotion of such a spirit. Our bonus system provides for a guaranteed minimum or base rate, with bonuses paid for production over the amount established as a production minimum. This system has increased earning capacity and lowered unit cost through increased production.

The different jobs coming into the department have been studied and classified, and equitable rates established. Three rates apply to dictaphone transcribing, depending upon the class of work. Technical dictation carries the highest rate, semi-technical dictation the next rate, and simple commercial dictation the lowest rate for transcribing. These rates are checked periodically for possible changes or corrections. Copy work is divided into three classes — tabular, handwritten, and typewritten—each class carrying its rate. Copy jobs are classified individually by the supervisor as they enter the department.

Balanced Classifications

This classification of jobs allows an operator to earn as much on one class as on another, and makes it possible to distribute work in the department, and maintain an even flow.

Maintenance of quality is one of the most important jobs the stenographic supervisor has. Upon quality more than any other factor will confidence be built up in the department, and if that quality is unquestionable, new people and new departments will be seeking service from the stenographic department, and expansion will be a natural, healthy process rather than a forced one. The checking and inspection of finished work must be carefully planned and accomplished. Penalties in the bonus system for errors in typing aid in the maintenance of the proper standard of quality.

5. Physical Set-Up of Department. Ventilation, lighting, chairs, and positioning of desks should be studied and corrected. A chart showing the number of times a messenger had to walk the length of the department daily, in distributing work and supplies to the operators, revealed a duplication of effort which was corrected in our department. The elimination of noise and vibration is an important factor in lessening fatigue and increasing production.

6. Economy. Centralization of any form of office function provides the opportunity to study economy. Savings in labor and materials are bound to accompany centralization. Centralization of stocks of supplies guards against losses and waste. A detailed study of the use of carbon paper showed our company the economy of using a high grade of material, with a resulting saving in cost. Printed forms, interleaved with carbon, have taken the place of forms where carbon had to be inserted. Window envelopes have been adopted for invoices, checks, and correspondence, resulting in a saving in labor and the elimination of errors in addressing envelopes. The possibility of errors in insertion of letters into envelopes has also been eliminated through the use of window envelopes, and a saving is thus made in checking time.

Saves Non-Productive Time

Continuous-form letterheads are being used for correspondence. Such forms are prepared in sets of fifty, and are used with shifting carbon. A saving of 5 per cent in non-productive time for set-up results; the work is kept clean since the operator does not touch the carbon paper, and the grade of paper and printing is maintained at the same quality standard formerly used on cut letterheads. Production has increased 12 per cent.

[Another article, dealing with equipment and production records in the stenographic department, will be published in an early issue.—Ed.]

In its centralized typing department, Bausch & Lomb has found these things important: well planned layout, good working conditions, a bonus system, up-to-date equipment

Provisions of Security Act

Not passed as we go to press, but apparently close to becoming a law. Like Labor Disputes Act, probably unconstitutional

What is the Social Security Act?

An act to establish old age pensions, unemployment compensation, aid for dependent and crippled children, provisions for maternal and child welfare and public health.

What parts directly concern industry?

Compulsory pensions and unemployment compensation.

How is industry concerned?

It has to pay taxes for both pensions and unemployment compensation.

What are the tax amounts for pensions?

Employer must pay an excise tax on all wages up to $3,000 per employee, tax to be levied in the same percentages as are employee contributions. Each employee must contribute one per cent of his wages up to $3,000 for the years 1937-39, one and one-half per cent for 1940-42, two per cent for 1943-45, two and one-half per cent for 1946-48, three per cent after December 31, 1948.

Who receives the taxes?

The Secretary of the Treasury of the U. S., through Bureau of Internal Revenue. He deposits them in the Treasury "Old-Age Reserve Account." Funds must be invested in federal securities. Special obligations issued exclusively to the Account are permitted.

How will taxes and contributions be collected?

Employer must deduct employee contributions from wages and pay them along with the excise tax to Bureau of Internal Revenue.

Any penalties?

Yes, interest at rate of one-half of one per cent per month for delinquencies until tax is paid.

Do payments of pensions start immediately?

No. They begin on January 1, 1942, or on the date when the individual attains the age of 65, whichever date is later. Payments terminate upon death.

Probably you studied the "Economic Security Act," introduced early this year (*Factory*, Feb., 1935).

Even though you did, don't assume that you understand the present "Social Security Act."

Consider these typical points of difference:

Old Bill	Present Bill
PENSIONS	
Employees earning $250 or less per month contributed—employer paid like amount	All employees pay—on their earnings up to $3,000—employer pays like amount
Any employee for whom tax had been paid was eligible to receive benefits	Any worker (and that means anybody employed, from president down) is eligible
UNEMPLOYMENT COMPENSATION	
Employers of 4 or more taxed for fund on basis of payroll with exception of non-manual workers getting above $250 a month	Employers of 8 or more are taxed on the basis of *entire* payroll—means all income paid to everybody

Who will receive pensions?

Any worker of 65, who has earned wages of not less than $2,000 after December 31, 1936, and before attaining the age of 65. He must have had wages paid to him after December 31, 1936, and before attaining age of 65 on at least five days, at least one day in each of the five calendar years.

How much will the pensioner receive?

1. If the individual receives total wages of less than $3,000 after December 31, 1936, and before attaining 65 years of age, he will receive monthly benefits of one-half of one per cent of his total wages.

2. If total wages have been more than $3,000 he will receive (a) one-half of one per cent of $3,000 plus (b) one-twelfth of one per cent of amount of wages exceeding $3,000 and not exceeding $45,000, plus (c) one-twenty-fourth of one per cent of amount by which wages exceed $45,000.

3. Maximum monthly rate shall not exceed $85.

Suppose employee works after 65.

Benefits will not start until employment ceases, but contributions continue and pension is reduced.

What payment is made if death occurs before 65?

The estate receives three and one-half per cent of total wages paid after December 31, 1935.

Are there exceptions for private plans?

If a pending amendment is passed, private plans that have been approved by the Social Security Board, exempt the employee from the federal plan, if he elects to participate in the private plan. Employee may withdraw from employer plan, still be eligible for federal pension. All back taxes with interest must be paid to U. S. Treasury.

What is unemployment compensation?

Cash benefits payable to individuals while they are unemployed.

Who is to be compensated?

Employees as designated under State laws, now in effect, and when and if passed.

Who will administer this compensation?

The states.

What part will the federal government play?

Give credit for 90 per cent of employer tax to companies paying into an approved State fund. Give financial assistance to states for administration. Be custodian of the State unemployment funds, by means of Unemployment Trust Fund.

What is the Unemployment Trust Fund?

A trust fund in the Treasury of the United States, where state unemployment agencies must deposit their unemployment insurance funds. The Secretary of the Treasury is to invest in United States Government bonds portions of the Fund not immediately required. Special obligations issued exclusively to the Fund are permitted.

What conditions must the state law meet?

It must provided that (1) public employment offices where benefits will be paid are designated and in existence; (2) no compensation will be paid until two years after the first contribution is required; (3) all money received in unemployment fund will be immediately paid over to the Unemployment Trust Fund; (4) all withdrawals from Fund will be used in payment of compensation; (5) compensation will not be denied if individual refuses new work because position is vacated as result of labor dispute, conditions are less favorable than those for similar work in the locality, employment will require worker to join a company union or resign from or refrain from joining any "bona fide" labor organization.

Who pays for this insurance?

Employers must pay an excise tax on total wages. One per cent of wages must be paid in 1936, two per cent in 1937, and 3 per cent thereafter.

Who is an employer?

Anyone employing a total of eight or more persons for twenty days or more in one year, each day being in a different week.

What are wages?

All remuneration for employment, including the cash value of all remuneration paid in any medium other than cash.

When and how must tax be paid?

By January 31 next following the taxable year. Returns will be made to collector of internal revenue for district. Taxes may be paid in four installments which will be due on January 31, April 30, July 31, October 31. Credits may be taken for amounts paid to states.

What are penalties for late payment?

One half of one per cent of the unpaid tax will be charged for each month after due date, until tax is paid.

Will extensions of time for payment be made?

Yes, for six months or less from the date payment or installment is due. Interest at rate of one-half of one per cent per month will be charged.

Will separate employer or employer-group funds be permitted?

If a pending amendment is retained the "Wisconsin plan" or equivalent will be permitted.

What is the Social Security Board?

An independent agency created by the Act to administer provisions of the Act. Three members, appointed by the President, will compose the Board, and will serve terms of 6 years at yearly salaries of $10,000. The Board will perform duties imposed by the Act. It will make studies and recommendations for regulation and legislation providing economic security through social insurance.

It will also receive applications from employers who desire to operate private annuity plans providing benefits in lieu of those provided under the Federal Old-Age Benefits (if pending amendment is adopted). If these plans meet requirements imposed by the Act, the Board will issue certificates of approval.

Is the Social Security Act constitutional?

Only Supreme Court can say. There is much opinion that it is not. Attempts at early decision will be made.

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Yes, No Windows

NEWEST window-less factory building is the one now being erected at Hershey, Pa., to house executive offices, printing plant, and paper storage rooms of the Hershey Chocolate Corporation. Executives of the company expect a marked increase in efficiency and comfort.

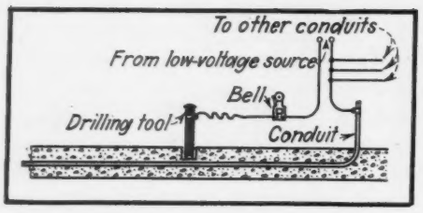
Conditioned Air

Conditions to be maintained in the new 3-story structure are 80 degrees dry bulb, 65 degrees wet bulb in summer, and 75 degrees dry bulb with 48 per cent relative humidity during the winter season. A 135-ton water cooling system and a complete system of fans, ducts, grilles, and accessory equipment will provide circulation of conditioned air at the rate of 90,000 cubic feet per minute.

Front half of first floor contains lockers and showers for employees; printing plant and paper storerooms are located in the rear portion of the building.

Offices, visitors' room, and lobby are housed in the front half of the second and third floors. To eliminate any possibility of disturbance due to transmission of vibration from heavy printing machinery, front and rear portions of building are isolated from each other.

OPERATING SHORTS



Precautions When Drilling in Concrete Floors

S. H. COLEMAN, *Waynesboro, Va.*

When it is necessary to drill holes in concrete floors in which conduits carrying electrical circuits are buried, every precaution should be observed to avoid coming in contact with live conductors. Indiscriminate drilling in such locations is extremely hazardous, both to the operator of the drilling tool, and to continuity of operation. Even though blueprints are available, showing the location of conductors, one must allow for inadvertent or unmarked intentional changes made during installation.

In any location where conduit is apt to be buried in the concrete, drilling should proceed slowly, using very light hammer blows on the drilling tool. The opening should be cleaned after every three or four blows, and inspected with a flashlight for the presence of metal. If metal is found, careful probing with a chisel or point is necessary to differentiate between reinforcing metal and conduit. Where conduit containing high voltage conductors is present, the operator of the drilling tool should use the same protective equipment used in working on an open line carrying the same potential.

To supplement the above precautions, it is often advisable to rig up an electrical indicator circuit as shown in the sketch. Utilizing a bell and low voltage source of current, this circuit is arranged so that contact of the drilling tool with buried conduit will be indicated by ringing of the bell.

Too much dependence should not be placed in the bell indicator circuit however. There is always the possibility of failure of the circuit due to high resistance joints in conduit piping, failure to connect to conduit properly, or failure of low voltage current. Possibility of failure may be minimized if, wherever possible, before starting drilling operations, all conduit which might by any conceivable chance pass through the area in which the drilling is taking place, is checked for conductivity at both exterior ends with the tool end of the bell circuit.

Mr. Coleman's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

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Tools Outlined in White on Black Board

MARK BELL, *Passaic, N. J.*

In our power plant trouble and loss of time were caused by workmen mislaying tools, such as wrenches, drills, hammers, chisels, and so on, or leaving them on the various jobs. Such schemes as locking the storeroom and making a list of the tools a man drew out were not satisfactory after the initial enthusiasm wore off.

Eventually I had several large wooden panels made and fastened to a wall. Practically every tool used was hung on small clips or hooks. With the tools in place I traced the outline of each with a pencil. The panels were then given two coats of black paint, and the outlines of the tools were painted white.

When the tools are in place the white outlines are not seen. However, if anything is missing the white outline shows up too prominently to be overlooked, and steps are immediately taken to locate the missing tool.

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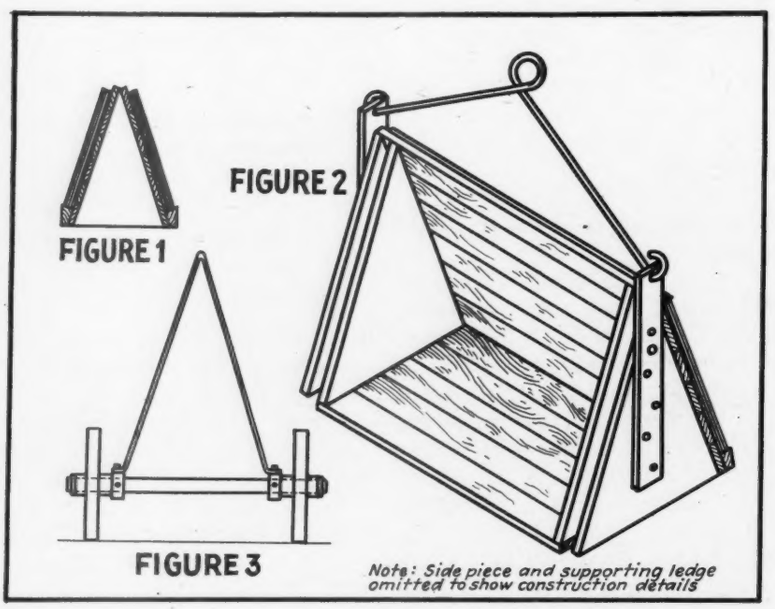
Device for Handling Sheet Materials

JOHN E. HYLER, *Peoria, Ill.*

The units shown can be made the basis of a system for handling sheet metals, plywood, plate glass, or other sheet materials by truck, crane, hoist, or conveyor. The principle involved is that of stacking sheets on edge, but out of plumb. The units are made up as illustrated in Figure 1. They consist of four triangular pieces on which are nailed oblique rack sides with pieces of hardwood along the bottom edges to support the sheets.

All other details of the unit as illustrated in Figure 2 are intended to facilitate handling. Thus the four triangular pieces are grouped to form a pocket at each end and a bottom is added between the two inner triangles. The bottom strengthens the assembly and makes it suitable for handling by conveyor or on flat trucks, particularly with short sheets.

For longer sheets the pockets become useful. Into them slip truck wheel assemblies such as shown in Figure 3. These are ordinary wheel-and-axle assemblies with the addition of the inverted V-members which, on



the rear assemblies, fasten to the axles and on the front to pivoted bolsters to make steering possible.

When the units are to be handled by crane, hoist or trolley, iron straps are fastened to each end to accommodate bails. If bail-eyes are correctly centered and an equal weight of sheets is placed on each side, the unit will handle nicely.

Thin sheets that have a tendency to buckle will hug the sides better if the sides are made slightly concave. Sides should also be made less steep for very thin sheets.

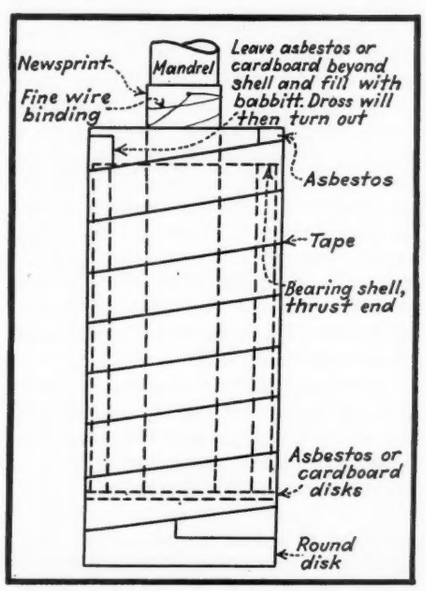
•

Babbitting Bearings

L. A. HUNT, *Service Engineer*
Bepco Canada, Ltd., Toronto

Considerable trouble has been experienced in rebabbitting bearing shells, and in quickly replacing a worn bronze bearing when suitable bronze is not available. Usually a bearing shell is placed on a metal plate and packed around with clay. A metal mandrel is placed inside, the set-up is heated, and the babbitt poured. Too often the weight of babbitt pushes through the clay and the pouring is lost.

A quicker and more satisfactory method makes use of a round disk approximately the diameter of the bearing shell. A washer will do if



a solid piece cannot be found. Place a double thickness of asbestos paper or cardboard on this object, roll a double thickness around the shell, place the shell on the cardboard covering the disk, and tape over the shell and disk with friction tape.

About five turns of ordinary newspaper should be rolled around the mandrel and held with fine wire. Slide this newspaper along to expose one end of the mandrel, and heat this end with the blow-torch; then tap the hot end on the bench to bring the paper back to the end of the mandrel. Hold the torch inside the shell, away from the paper exposed at the top. Place the mandrel in position in the shell, and pour the babbitt which should be just hot enough to scorch a pine stick held momentarily in it. When the bearing cools, the mandrel is easily withdrawn due to the shrinkage of the newspaper. There are no pouring failures, as the cap held with friction tape on the bottom forms an effective seal.

To repair a bronze bearing quickly, chuck it approximately central and remove $\frac{1}{8}$ inch or more metal inside with heavy cuts, leaving the inside very rough. This roughness forms an effective anchor and the shell need not be tinned. Now rebabbitt this shell, as mentioned above, accurately center it in the lathe, and face to size. Turn oil rings at each end, set the bearing $\frac{3}{8}$ inch off center with the former oil ring grooves (now filled with babbitt) as the high part, and turn the babbitt out of the former grooves. Turn the lathe tool in the boring-bar sideways, and with the chuck stationary run the tool by hand to gouge out an oil groove from end to end, passing the edge of the oil ring groove just turned. Give the chuck a half revolution and run a similar groove on the other side. A touch here and there with the scraper, and the bearing can be reinstalled.

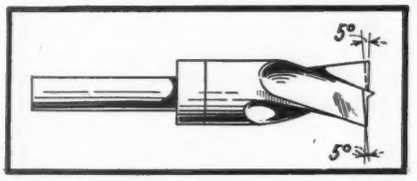
Air conditioning was applied to the cabs of the 35- and 75-ton cranes at A. M. Byers Company when terrific heat incidental to the manufacture of wrought iron threatened to overcome operators. Refrigeration units of $\frac{1}{3}$-ton rating, driven by $\frac{1}{3}$-hp. direct-current motors, were installed on top of cabs, with evaporators mounted below compressors. Cold-air duct was run to corner farthest from operator, and return duct was mounted on cab ceiling near operator's head. Insulation one and one-eighth inches thick and a metal screen mounted in front of cab window to protect operator from radiant heat completed the job

•

Special Drill for Leather or Fiber

H. E. SLADEN, *Philadelphia*

When drilling leather or fiber it is usually impossible to make a clean, smooth hole by using either a wood bit or a twist drill ground to the usual angle. For this type of work a worn or broken drill, ground as indicated in the sketch, will be



found very satisfactory. To grind it the drill is held in a chuck in the lathe and a toolpost grinder and

small wheel used to grind the lips flat and form the sharp point.

Clearance on the lips is ground by hand on a bench grinder, care being exercised not to injure the point.

•

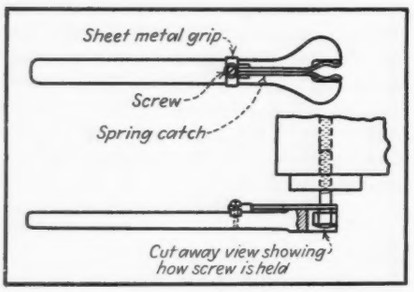
Spring on Wrench Catches Screws

FRANK MOORE
Hamilton, Ontario, Canada

When taking out screws and bolts there is always a chance that they will drop in some part of a machine where they will be hard to recover or, worse still, where they might cause serious breakage.

After experiencing an incident of this kind, I fitted a wrench with a spring to catch the screw as it came out of the hole. The drawing shows the shape of the spring and how it is attached to the wrench with a screw and sheet metal grip. The grip is made of flat steel bent over to fit the wrench, drilled for the screw, saw-slotted, and bent up to enclose the spring and hold it straight.

The side of the wrench opposite the spring is used uppermost first to loosen the screw enough to give the wrench a clear swing. Then it is turned over and pushed on the screw head so that the catch will snap over the shank.



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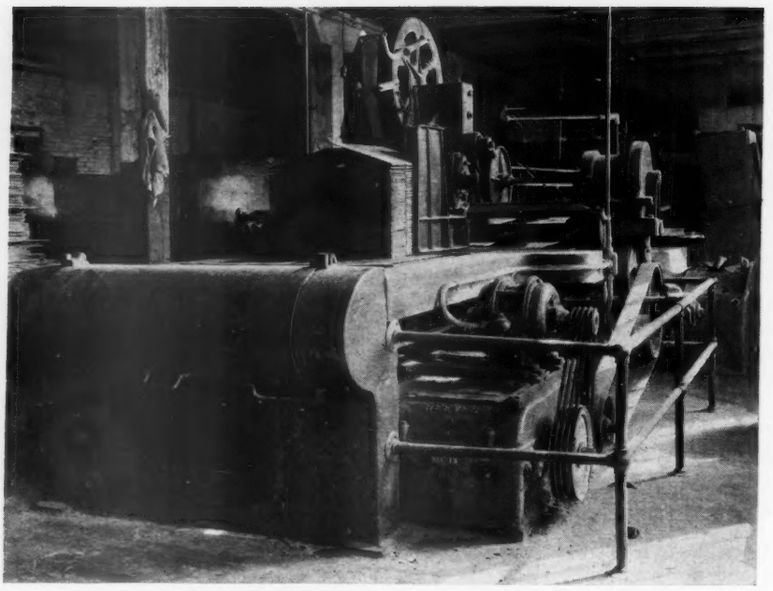
Permanent Magnet for Flashing D.C. Generator Field

H. T. CLARK, *North Wilkesboro, N. C.*

A method that I use for flashing direct-current generator fields may be useful to others.

When the construction of the generator is such that it can be done, I hold a permanent magnet in such position that the ends touch two adjacent poles of the field, and bring the machine up to normal speed. In every instance that I have used this method the induced magnetism has been enough to cause the generator to pick up at once.



Variable-Speed Transmission Saves $1,400 a Month

LEONARD CHURCH
Regional Editor, Cleveland

Martin Bros. Barrel, Box & Lumber Company, of Toledo, Ohio, established a branch plant in Aurora, Ind., about a year and a half ago for the manufacture of corrugated paper boxes.

In equipping this plant, the company purchased a corrugating machine said to be the largest of its kind in the world. It takes a three-strip section of strawboard, corrugates it, and pastes a sheet of paper on each side, forming in one operation a double-faced sheet of corrugated board. It then cuts the strips into sections of required length.

Variable-speed control of this machine is an absolute necessity because of several factors. One is that different grades of stock are processed. Another, that when a new roll of paper is put on, the machine should be slowed down so the splice can be made without stopping the machine and interrupting production. In the third place, the speed of the cut-off knives must be synchronized with the speed setting of the driving end to compensate for time lag in operation of clutches in the cutters.

When the corrugator was purchased, a slip-ring variable-speed motor was specified, largely because of lower first cost as compared with that of a constant-speed motor and variable-speed transmission. The motor was installed and began to give trouble immediately.

Speed settings could not be maintained accurately. Because of the fluctuation it was impossible to synchronize cut-off speeds with the driving speeds. This resulted not only in considerable waste in cut sheets but also in damage to the cut-off knives, necessitating frequent shutdowns for repairs and adjustments. Inability to accelerate smoothly after slowing down to make a splice caused breakage in the sheets and lost time in resplicing. Furthermore, the speed variation required to handle different grades of stock could not be secured because of poor regulation of the drive.

With this motor driving the corrugator for nearly a year, time down averaged 4 hours in a 16-hour machine day. This time is conservatively valued at $14 an hour. In producing corrugated fibre boxes, as in the manufacture of any other product, there is a certain amount of unavoidable waste. During the most satisfactory month of operation with the variable-speed motor, this waste amounted to 5.5 per cent—a figure altogether too high for efficient and profitable production.

Continued lack of success in overcoming these difficulties finally resulted in throwing out the variable-speed motor and replacing it with a variable-speed transmission with electric remote control. Since this installation was made there has been no down time chargeable either directly or indirectly to the driving equipment. Furthermore, the percentage of waste was reduced in the first month of operation from 5.5 per cent to 2.7 per cent—a 50 per cent cut. Waste per month is worth $500.00 per one per cent. The actual value of waste is thus reduced from $2,750 a month to $1,350 a month —a saving of $1,400.

Of course, all splices are now made without stopping the machine and acceleration to production rate is made smoothly and rapidly. The full speed range over a 4:1 ratio is available and speed settings are positively maintained as long as desired.

Since the transmission was installed, production as high as 88,000 square feet an hour and 1,000,000 square feet in a 16-hour day has been attained. Ordinarily, however, these speeds are too fast for the cutters. The usual rate is about 190 lineal f.p.m., although speeds of 250 f.p.m. are possible. The management can now forget about a variable-speed control problem and concentrate on economical, high-speed, quality production.

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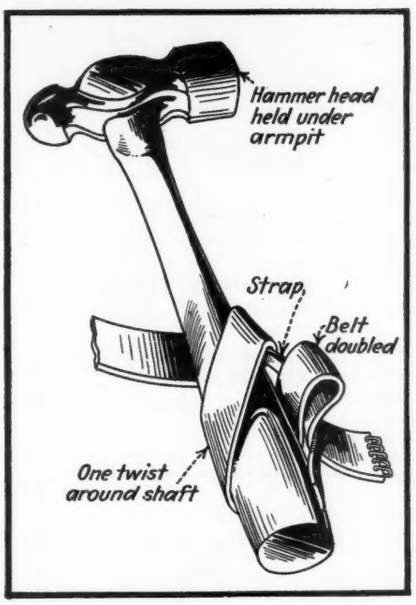


Hammer Used as Belt Holder

H. MOORE, *Hamilton, Ont., Canada*

Experiencing the usual difficulty of holding two ends of a belt together while slipping the fastener pin in place, a belt repair man solved the problem on light belts by using his hammer as a holder.

To do this it was merely necessary to fasten a short leather strap to the handle.

In order to hold a belt it is doubled over near one end and pushed between the handle and the strap. A turn or two of the handle twists the belt around the end and holds it tight. The hammer head is then tucked under the repair man's armpit. Then he uses one hand to insert the pin, and the other hand to hold the other end of the belt.

The belt is freed from the hammer by slipping out the doubled part.

Shifts Average 42 Hours For 4 Weeks

K. S. SMILEY, *Plant Engineer*
The Kendall Mills
New Bedford, Mass.

You have published recently (September - December, 1934) various shift schedules none of which fitted our particular problem. That problem was to continuously fire our steam plant with one fireman per shift, and fulfill the following conditions:

1. Maximum hours per week for firemen shall be 48. (Textile Code.)
2. A fireman must be allowed at least 24 consecutive hours off in seven-day period. (State Law.)
3. Rotate shifts among men to equalize night shifts, days off.
4. Allow, if possible, each fireman to average the same number of hours per week.

After considerable figuring and "burning of midnight oil" we have evolved this schedule which has proven satisfactory. We wish to point out that the long shift of 12 hours comes on Sunday when only one boiler, instead of four, is in operation. Over a four-week period each man works 168 hours, averaging 42 hours per week. The man who works the midnight to 8 A.M. shift on Saturday has 28 hours off before he must report for work at noon on Sunday.

	S	M	T	W	T	F	S
3	1	1	1	1	1	1	
	2	2	2	4	4	2	
4	4	4	3	3	3	3	

	S	M	T	W	T	F	S
4	2	2	2	2	2	2	2
	3	3	3	1	1	3	
1	1	1	4	4	4	4	

	S	M	T	W	T	F	S
1	3	3	3	3	3	3	
	4	4	4	2	2	4	
2	2	2	1	1	1	1	

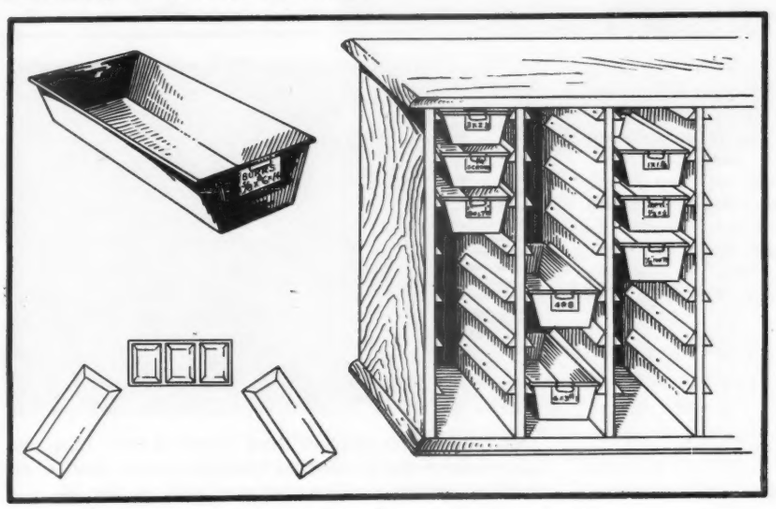
	S	M	T	W	T	F	S
2	4	4	4	4	4	4	
	1	1	1	3	3	1	
3	3	3	2	2	2	2	

Baking Pans Aid Assembly and Maintenance

F. DEWDNEY, *Foreman*
Imperial Rattan Company, Ltd.
Stratford, Ontario, Canada

Two sizes of baking pans save us many a dollar. We use them for holding small parts on the assembly benches. Three of the smaller pans just fit inside one of the larger and both sizes can readily be arranged to form the familiar semicircular work place, greatly facilitating the job of small parts assembly.

Pans full of parts awaiting call are stored in a rack. The same racking principle is employed by the maintenance force for storing nuts, screws, washers, etc. These racks permit the pans to be pulled out for quick, easy inspection of contents, and pasted-on identification labels save a great deal of time.



SPECIAL NOTICE

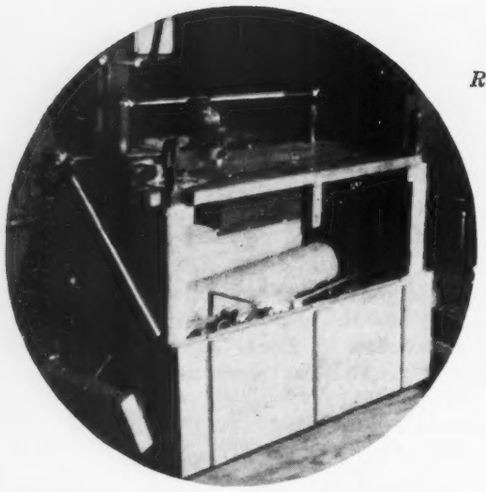
$10 will be paid for the best Operating Short submitted during the month of August. The Editors are the judges. Other Shorts accepted will be paid for at attractive space rates

Motion-Economized Maintenance

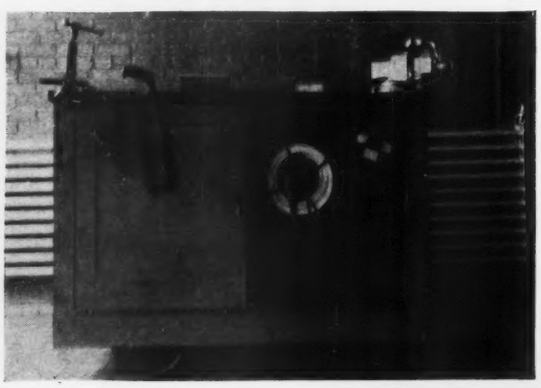
Measure maintenance motions with process chart and see how shops on wheels can save time and money

W. H. DAVIS
Plant Engineer

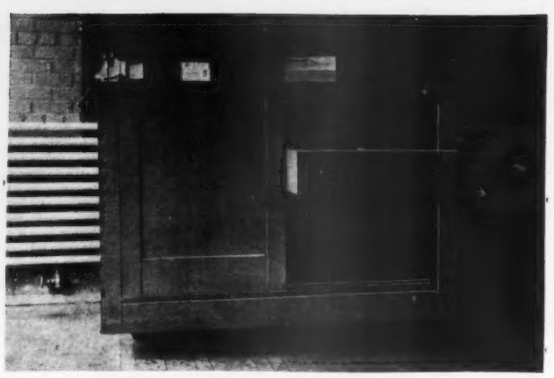
E. H. MACNIECE
Operating Superintendent
Remington Arms Company, Ilion, N. Y.



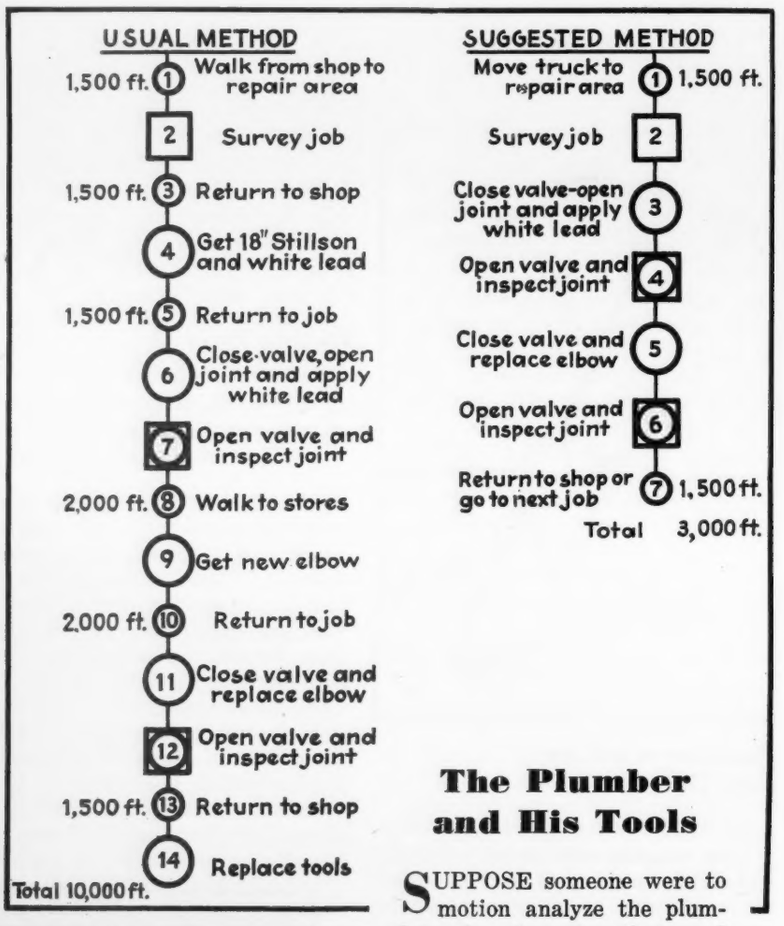
Pipe shop on wheels saves Remington plumbers the extra mile or two found in the process chart of the plumber who came without his tools. This truck contains all tools needed to do a repair job, also replacement parts, gasket material, and so on



Electricians, too, have trucks that bring shop to job. Sliding doors cover a compartment for reels of wire, tools, etc. Top boards have holes in which pins are inserted to hang tools on while operator is working

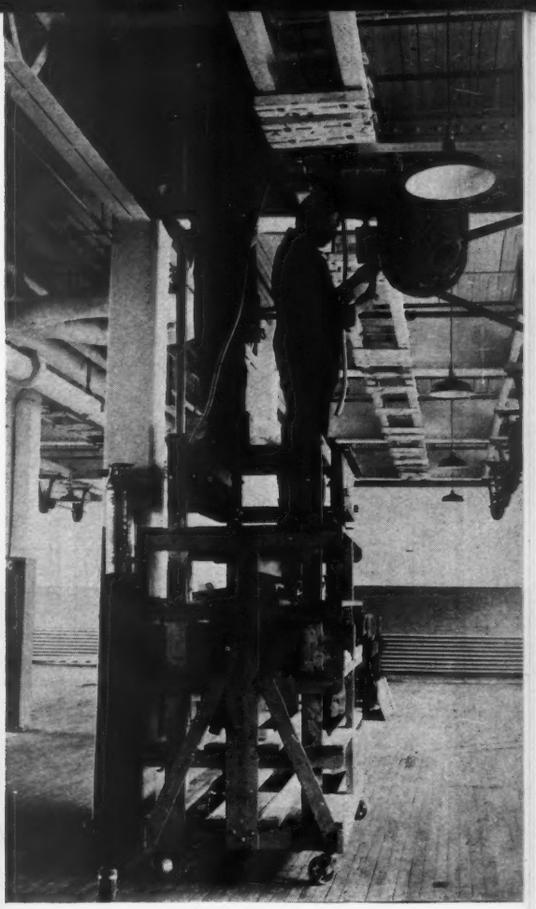


Other side of electrician's truck shown above. There are six commodious drawers in which he keeps small tools, fittings, sockets—anything he may need on the job


USUAL METHOD
1,500 ft. 1 Walk from shop to repair area
2 Survey job
1,500 ft. 3 Return to shop
4 Get 18" Stillson and white lead
1,500 ft. 5 Return to job
6 Close valve, open joint and apply white lead
7 Open valve and inspect joint
2,000 ft. 8 Walk to stores
9 Get new elbow
2,000 ft. 10 Return to job
11 Close valve and replace elbow
12 Open valve and inspect joint
1,500 ft. 13 Return to shop
14 Replace tools
Total 10,000 ft.
SUGGESTED METHOD
Move truck to repair area 1 1,500 ft.
Survey job 2
Close valve-open joint and apply white lead 3
Open valve and inspect joint 4
Close valve and replace elbow 5
Open valve and inspect joint 6
Return to shop or go to next job 7 1,500 ft.
Total 3,000 ft.

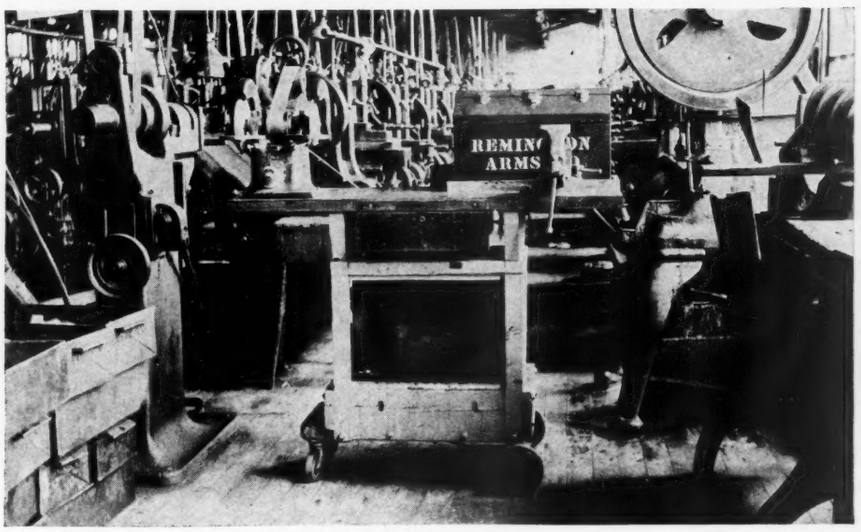
The Plumber and His Tools

SUPPOSE someone were to motion analyze the plumber who, observing that good old plumbing custom, left his tools at home! The process chart would look like the one at the left. Right, process chart for same plumber, same job, but a better way to do it. Motion economy has taken out 1½ miles of needless walking.

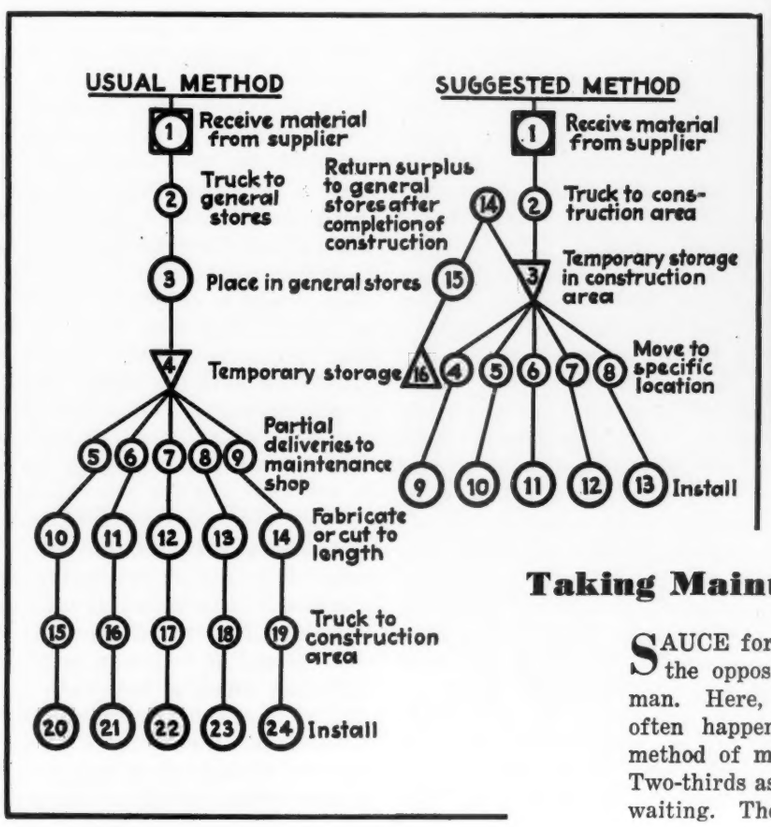


For general overhead maintenance work the electricians have this high truck. It's safe. It's convenient. And the tools they need are always close at hand

Same truck spotted next to the machine being set up. This portable shop is equipped with vise, plug-in grinder, and a kit of tools

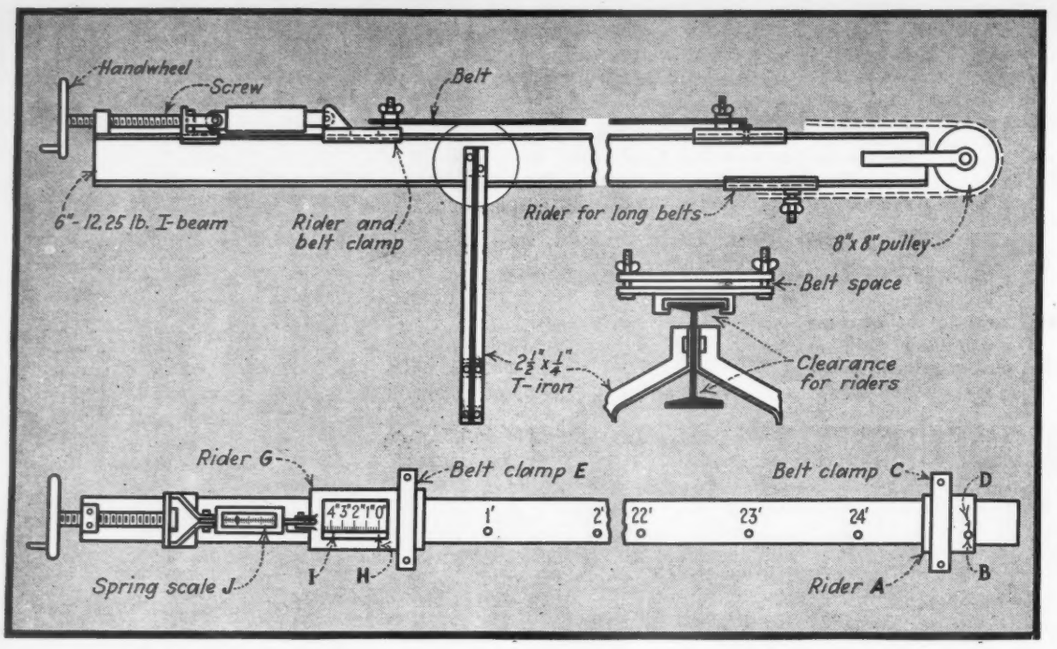


Modern layouts do not provide a great number of set-up benches close to production machines—and modern machine setters do not care to waste time walking. Hence this machine setter's truck


USUAL METHOD
SUGGESTED METHOD
1 Receive material from supplier
1 Receive material from supplier
2 Truck to general stores
Return surplus to general stores after completion of construction
14
2 Truck to construction area
3 Place in general stores
15
3 Temporary storage in construction area
4 Temporary storage
16
4 5 6 7 8 Move to specific location
5 6 7 8 9 Partial deliveries to maintenance shop
9 10 11 12 13 Install
10 11 12 13 14 Fabricate or cut to length
15 16 17 18 19 Truck to construction area
20 21 22 23 24 Install

Taking Maintenance Facilities to the Job

SAUCE for the plumber—see the process charts on the opposite page—is sauce for the maintenance man. Here, in familiar chart form, is what all too often happens. And again, the motion-economized method of moving maintenance facilities to the job. Two-thirds as many operations. Less paperwork. No waiting. The chart tells the story



Don't Guess at Tension

When putting on new belts or checking old ones it can be measured closely with a simple device that costs little to make

CARL W. SCHWABE
Superintendent, Mechanical Department
Mallinckrodt Chemical Works, St. Louis

MAINTENANCE of the proper tension is an important element in securing good belt service and long life. Leather belts that are run under excessive tension lose their natural elasticity and tend to deteriorate with undue rapidity. Insufficient tension is just about as undesirable as too much tension.

A Device to Test Tension

Measurement of the tension is part of our regular system of belt maintenance. In order to simplify this job, as well as take the guesswork out of cutting a new belt to the proper length so that it will have the desired tension when it is placed on the pulleys, the tensioning device shown was designed and built.

The cost was little, mostly for labor, since the device was made almost entirely from scrap materials. It could have been built in several different ways, but we had to adapt the design to the materials available.

As will be seen, it consists of a 6-inch, 12.25-lb. I-beam about 30 feet long, supported by legs of 2½x¼-inch T-iron. On the upper edge of the beam a series of ⅜-inch holes is drilled exactly 1 foot apart.

Two riders on the beam carry simple belt clamps. The rider at the right-hand side of the illustration has a hole in it that lines up with the holes in the edge of the beam, so that it can be held firmly by a pin inserted in the hole.

The left-hand rider is free to slide on the beam and fits over a 1-foot scale laid off in quarter inches and stamped on the beam. This rider is attached to one end of an ordinary spring balance or scale. The other end of the scale is attached to a small rider that is in turn attached to a long screw fitted with a handwheel, so that it can be moved back and forth along the beam.

In order to accommodate belts that are too long for the beam, an 8x8-inch pulley is mounted at the right-hand end of the machine. The belt is then run around this pulley and attached to a rider and clamp on the underside of the beam. In this way it is possible to handle a belt more than 50 feet long.

Using the Device

To show the procedure in using the device, assume that a ¼x4-inch belt is to be cut; that the tape line length around the pulleys is 25 feet; and that the tension desired in the belt when installed on the pulleys and running idle is 100 lb. per square inch. These operations are performed in the following order:

1. The rider *A* is placed so that the hole *B* and the hole at the 25-foot mark in the frame of the machine coincide, and the pin is inserted to hold the rider stationary.

2. One end of the belt is inserted in clamp *C* in such position that the end of the belt and the scribed line *D* coincide.

3. The other end of the belt is put in clamp *E* so that it coincides with the scribed line *H* on rider *G*. With the rider in such position that line *H* coincides with the 0 mark on scale *I*, stamped on the beam, and with hole *B* in register with the 25-foot hole, the distance between scribed lines *D* and *H* will be exactly 25 feet.

4. Having previously determined that a tension of 100 lb. will be required in the belt when running idle, the next step is to turn the handwheel until the scale *J* indicates a pull of 100 lb. Now the belt is under a tension of 100 lb. and rider *G* will have moved towards the left.

Right the First Time

5. The position of the line *H* on scale *I* is read. For the present purpose assume that this reading is 3 inches. The total distance between lines *D* and *H* will now be 25 feet, 3 inches, which is the length of the belt while under the desired tension of 100 lb. Obviously, if 3 inches are cut off the belt it will have this tension when installed on the pulleys.

When Voltage Varies

Keeping generator voltage within almost any limits desired under changing demands is not difficult and improves operating conditions

H. C. JENKS
Industrial Engineer
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

GENERATOR voltage regulators have in the past been somewhat of a stranger to plant operating men. Among the reasons are: Use of direct current for many applications; general impression that approximate speeds are sufficiently close for many operations; complete dependence upon the utility for voltage regulation; tendency to permit operating conditions to remain as they have been without much regard for improvements.

Use of the voltage regulator as a means of improving plant performance is increasing. Its application to industrial equipment will probably become widespread as plant operators and executives realize the benefits to be obtained by operating equipment at higher levels of efficiency.

With M.G. Sets

At present the most general industrial application of these regulators is to individual motor-generator sets. The sets may be used to obtain direct current from an a.c. supply or vice versa, or to obtain a desired frequency from a supply system of another frequency. Frequently the sets supply power to individual processes or mill trains that require better regulation than is normally obtainable from the general supply circuit. In many instances the output of the sets is supplied to motors only; lighting circuits are not involved. Even in these cases, although a fairly rough voltage regulation is permissible, when the output is alternating current and the load is variable it is necessary to provide regulators. Characteristics of modern a.c. generators do not permit their use directly on such systems without some automatic means of maintaining fairly constant voltage.

Another application wherein the requirements are steadily increasing is in connection with testing operations. Here, constant voltage or constant frequency is becoming more and more important. In some instances, particularly in life tests, the permissible fluctuation of voltage over a long period of time is surprisingly small; hence, use of a voltage regulator is practically imperative.

The industrial plant that operates its own generating equipment also presents a problem in proper voltage regulation.

Quality of the regulation required by the applications cited above may be summarized in the following tabulation:

A. Very rough, motor load only, particularly a.c.

B. Improved, where lighting is involved.

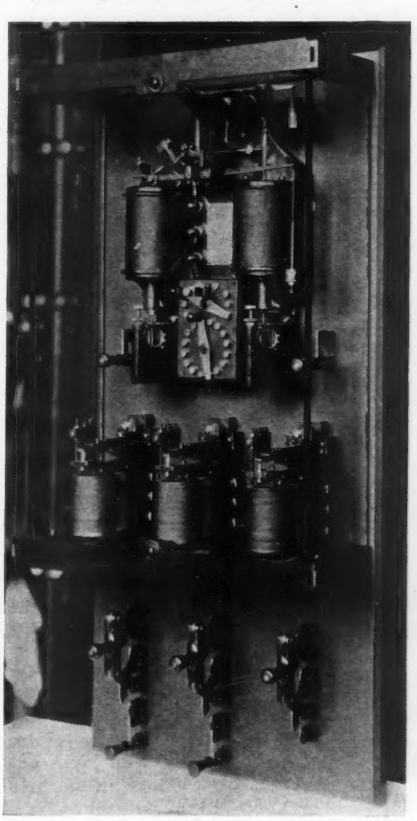
C. Extremely close, where processing is involved or precise testing or life tests are conducted.

D. In the power house.

When voltage regulators are to be purchased, the classes of requirements listed should be considered not only from the need of the installation, but also from the economic viewpoint. In general, the cost of regulating equipment will increase as the quality of regulation desired is raised. Also, it should be remembered that the cost of regulating apparatus increases as the size of the machines involved becomes greater.

Where the first class of applications is involved, the tendency is to apply regulators that will permit satisfactory operation without involving the expense naturally associated with the installation of extremely sensitive or accurate regulating equipment. When motor loads only are involved, regulating equipment that has a sensitivity of several per cent is usually satisfactory.

Regulator, vibrating type, for a.c. generators, acts through the medium of shunting relays in the generator field



For Motor Load Only

Several types of regulators are available for this service. Most popular are the vibrating and the carbon pile types. Selection of the proper regulator must be influenced by the permissible variation in voltage and by the size of the equipment to be regulated, since the capacities of the various types of regulators available are inherently limited by their construction.

For installations that do not require particularly close regulation, a modification of the standard vibrating type of regulator is avail-

able. This regulator utilizes the moving coil principle. The coil arm bears a set of small precious-metal contacts, which in turn actuate so-called shunting relays adapted to this service from the well-known vibrating regulator construction. Contacts of these shunting relays then control the field current of the machine being regulated.

This modification of the voltage regulator, although it permits handling of larger machines and gives somewhat closer regulation than the carbon pile type, requires somewhat more maintenance, which is natural in view of the type of contact involved. Maintenance usually consists essentially of reversing the current flow through the contacts at least once during every eight hours of service, and dressing them as wear progresses.

Requirements Determine Type

The carbon pile regulator has the advantages of low initial cost and comparative freedom from maintenance. However, it is limited in range of application since its capacity is definitely limited and it is somewhat slow in response, particularly to minor fluctuations.

For Class A applications where, in addition to providing power for operating motors, the generators feed lighting circuits, regulators with better performance are required. For some of these installations the type of regulator previously mentioned as utilizing shunting relays is satisfactory. Performance of this type of regulator is usually satisfactory for lighting circuits, but it is limited as to the size of machine it can handle.

When larger equipments are involved, it is necessary to go to the standard vibrating construction, which is available for both d.c. and a.c. systems. This type will meet the requirements for practically any of the usual voltage regulation applications for industrial work and will handle machines of the maximum size normally found in manufacturing plants.

More Sensitive, More Costly

When extremely close voltage regulation is required, as in Class C, where processing applications are carried on, precise testing is under way, or life tests are involved, it is necessary to use more expensive apparatus. For these precision applications the electronic type of voltage regulator is probably the most suitable. It has a sensitivity of a fraction of 1 per cent and a greater speed of response than is found in regulating devices previously mentioned. Its characteristics make it particularly suitable for laboratory work. Since there are no moving parts, maintenance requirements should be low. Primary parts to be renewed are restricted to the tubes and, in certain regulators, to constant-voltage batteries similar to the B-battery in radio receivers.

For Class D applications that involve use in power houses in connection with the main generating units, whose loads are fairly steady, an entirely different type of voltage regulator is frequently utilized. It is known as the rheostatic type. One of its characteristics is that, so long as the voltage is correct, no parts of the regulator are in motion. As soon as correction is required the regular control element operates to move the field rheostat of the machine and, in the event of extreme voltage disturbance, to actuate contactors that function on a principle somewhat similar to that of a vibrating voltage regulator, until such time as the rheostat has moved sufficiently to make the proper field correction.

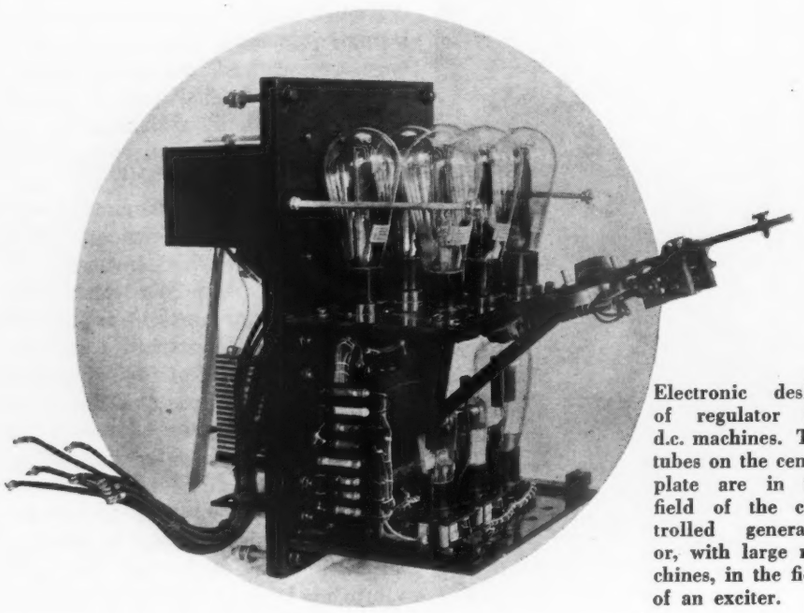
This type of equipment is applied to machines outside the range of application of regulators previously discussed. The fact that it is not continuously in motion and that its maintenance is low, coupled with the practical elimination of size limitations so far as the machines controlled are concerned, make this a popular type of device.

Also Speed and Frequency Control

It may be noted here that some installations require constant frequency or constant speed of operation for certain processes. For many of these applications voltage regulators are adapted to function as speed regulators. The type of regulator used is governed primarily by the same limitations that would hold for a voltage regulator application. That is, where the limits of variation are liberal, the less costly type of regulator is employed. On the other hand, where extremely close regulation is desirable, the sensitivity of the regulator is increased; consequently, its cost is higher.

Types of speed regulators available range from the less expensive and less sensitive devices to the more expensive and more sensitive electronic equipment. Normally, the rheostatic regulator is not used for speed-regulating purposes because its response might not be sufficiently rapid to take care of the exacting requirements of modern processes. Control of frequency, since it is definitely associated with the speed of the generator, could also come under the control of the speed

(Continued on advertising page 52)



Electronic design of regulator for d.c. machines. The tubes on the center plate are in the field of the controlled generator or, with large machines, in the field of an exciter.

To Prevent Belt Static

Always annoying, often dangerous, static charges can be prevented by proper drive design and keeping belts soft and pliable

WAYNE DAVIES
Chief Engineer
Chicago Belting Company, Chicago

EVERY plant man knows that static electricity is frequently generated by power transmission belts, as shown by the appearance of sparks or a filmy, bluish discharge. It may not be so well known that static electricity annually cause large losses from fire and explosion.

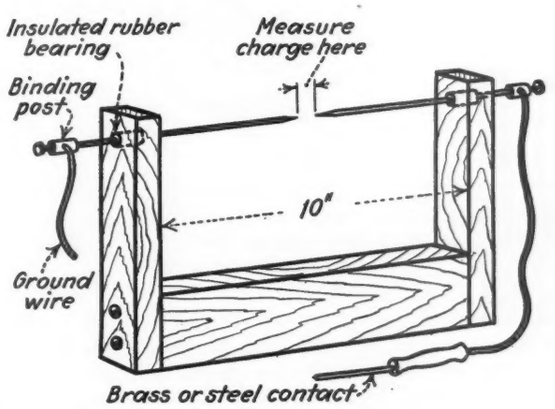
It appears that few have investigated static in belting, and those who have tried to overcome it have usually started from the wrong end of the problem. They have attempted to handle the static charge after it was generated, instead of trying to prevent its formation.

Friction Makes Static

According to present knowledge, static is always the result of friction in some form. It will also be remembered that there are two kinds of electricity or electric charges—positive and negative. For example, a positive charge may be produced by rubbing a dry glass rod with silk. Rubbing sealing wax or hard rubber with cats fur or wool, produces a negative charge. If cork and dry glass are pressed firmly together and then separated quickly, they will be found to be charged. Distortion of truck tires as they roll along produce a static charge, as gasoline truck drivers well know. Myriads of extremely small sparks, plainly visible in the dark, are produced at the point of separation, when rubber friction tape is unrolled, or peeled off a glass plate.

Many other ways of producing static electricity could be cited—so many, in fact, that when studying a problem that involves the production of such charges it is necessary to investigate friction and pressure between any two surfaces or bodies, even friction between the bodies and the atmosphere.

Transmission belting has often been credited with the generation of a charge which in all probability comes from other sources. The mandrel of a scrap lumber saw in our plant is mounted under a wooden table on an over-sized shaft in plain iron bearings. The steel plate around the saw blade is insulated by the wooden top of the saw table. Running idle at a comparatively low speed, this saw develops a very high voltage, apparently from bearing friction, since there can be no belt slippage on the idling saw, no creep, and very little pressure between the belt and the steel pulley. The only other source of an electrical charge might be the overhead transmission, but there is no charge on this equipment.



Voltage of a static charge can be estimated with this simple voltmeter. About 20,000 volts are required to force a spark between the needle points when they are 1 inch apart

Static electricity cannot be generated promiscuously in a damp atmosphere; so the easiest way to prevent static charges is to humidify the atmosphere to the point where they will be carried off or absorbed in the air. Ventilation of plant departments usually is sufficient, since static can seldom be generated in the open air; the average humidity is too high, except in a very arid region.

Static electricity may be developed by a belt of any material, even by a steel belt or band saw, under the proper atmospheric conditions. Some types of belts have been considered to develop and hold charges more readily than others, but investigation of many such cases has showed that the atmospheric conditions had more to do with the amount and strength of the charge, or its duration, than the belt material itself, since static is largely a surface charge.

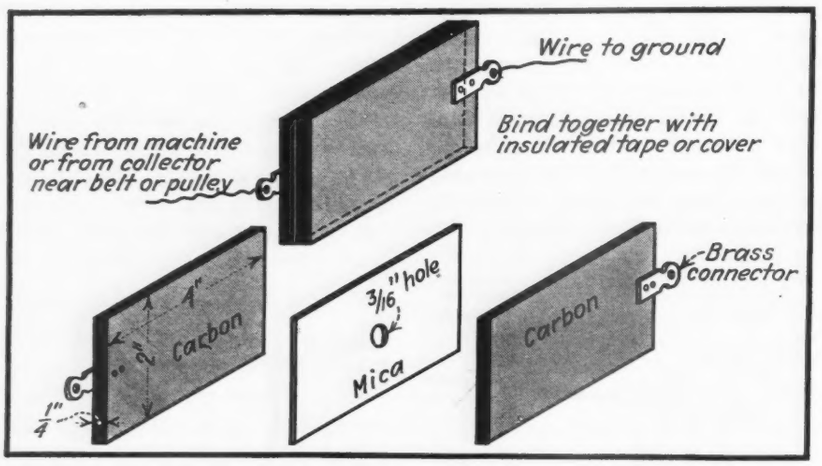
Belt slippage is rare in an elevator leg, and bucket belt speeds are considerably lower than power transmission speeds, but under some conditions such as a dry, hot atmosphere, the woven-fabric leg belts will develop a noticeable charge. In a dry atmosphere the charge will stay on the belt until heavy enough to discharge to some convenient metal part.

High Speed, But No Static

A leather belt is operated in a cereal mill in Chicago at a speed of 8,300 feet a minute. Since it is only 11 ft., 6 in. long, it makes 728 circuits a minute around the two pulleys. This belt develops no static charge in a reasonably dry atmosphere because it is properly dressed with animal oils, although the pressure against the pulley sur-

faces is high, and the speed more than twice that of the average drive, with a very high air friction.

If this belt were allowed to dry out so that internal friction was developed, as well as slippage on the pulleys, it would develop a very large amount of static electricity, which would be dangerous because of the high speed of its generation and the danger of an almost constant discharge to adjoining equipment.



Static charges can be dissipated without visible sparking by interposing two carbon plates separated by a sheet of mica between the belt or machine and ground

Under the most favorable conditions of dry air and friction, such a charge can be built up to 80,000 or 100,000 volts, or higher, and will spray a fan of sparks 2 or 3 ft. long.

Preventing Saves Curing

Puzzling static problems have been met in certain industrial plants. For example, there is an installation of three air compressors in the same room, all supposedly identical, belt-driven installations. One of these drives develops heavy charges of static, whereas neither of the other two shows any charge under a simple test.

The three installations can hardly be identical, however, because belt tensions on three average drives cannot be measured or kept exactly the same. Several other conditions which at first thought are assumed to be identical, are found to be quite different when carefully examined. Friction and internal fibre distortion vary considerably with pulley crown and pulley alignment. Hence, there are too many variables to leave any mystery.

Condition of the belts has a bearing on the problem, as have the loads on the compressors and the operation of their valves and unloaders. All of these influence slippage, as do even the bearings of the motors and the compressors. Again, the compressor that develops static may have been completely insulated, or at least more poorly grounded than the others.

From my point of view as a transmission engineer, it has always seemed that the most practical way to prevent formation of static in transmission belts involves proper drive design, reasonable loads, use of high-quality belting with a good gripping surface, and careful maintenance of belting, bearings, shafting, and other transmission equipment, as well as proper ventilation. In the past many attempts have been made to prevent static charges on drives by the use of a belt dressing in which some electrical conductor was incorporated. Belts have been made with copper ground wires woven into them. These seem to me to be attempts to cure when the old ounce of prevention would be the most logical remedy.

A leather belt with a high coefficient of friction, operating on a properly designed drive without more than 1 to 1½ per cent slippage, which is barely over the limit of creep, and perfectly natural, will not develop a static charge, if the leather in both plies is treated periodically with neatsfoot oil or dressed with any one of a number of other animal or vegetable oils that will keep the leather in perfect condition and eliminate internal friction.

Where it is impossible to prevent generation of static on transmission equipment, grounds or leaks may be provided to dissipate or absorb the charge. Copper wires attached to machine frames can be grounded to water pipes. Handrails near moving belts can be grounded in the same way. Jack- and line-shaft hangers can be grounded, so that practically no metal parts are left ungrounded for the collection of a static charge.

Static may be developed in hammer mills or attrition mills because of the condition under which they are operating, or the material being treated. When static is found in such equipment, it can be carried off by proper grounds.

One of the most practical grounds for machines that are likely to develop static charges can be made from two small, flat pieces of carbon with a thin sheet of pure mica between them. This is a common form of lightning arrester used by the telephone companies. The carbon pieces can be about ¼ in thick, 2 in. wide, and 4 in. long. The mica sheet should be the same size, and have a hole about ⅜ in. in diameter in the middle. A copper lead wire is secured to one carbon, with the ground wire leading from the other. The two carbons, of course, should be held together, but insulated from each other.

When a charge is carried into one carbon it will cross the gap between the carbons through the hole and leak away in the ground wire without producing sparks.

Measuring Static Charges

For detecting and measuring electrostatic charges a simple voltmeter to be used in series between the machine and ground can be made from two needles mounted on an insulated frame, with their points toward each other. One needle or both should be arranged to slide back and forth, to permit varying the gap.

When these needle points are separated a distance of 1 in., 20,000 volts is required to jump this gap. It requires 5,000 volts to jump a ¼-in. gap; other gaps of greater or less width require voltage in direct proportion.

(Continued on advertising page 52)

Some Jobs Don't Rightly Mix

Electrical maintenance and construction, for instance, require different types of men, so it's better not to take a man off one to do the other

GILBERT LINDGREN
Assistant Chief Electrician
Hudson Valley Fuel Corporation, Troy, N. Y.

THE LONGER I supervise maintenance work the more convinced I am that maintenance men should not, or rather cannot, do electrical construction work. I am referring, of course, to good construction work and good maintenance work.

In the first place the man who is really good at maintenance work and is also a good construction man, does not exist. The two jobs require entirely different types of men. A good maintenance man likes to tinker, wants to inspect everything, insists on finding out how and why it works. He likes to hear a smooth-running machine and should be a fair student of electrical theory, so that he can run an ordinary load test on a.c. or d.c. motors and make out an intelligent report on troublesome equipment.

It is necessary that he be able to get along with a wide variety of operators and foremen, and keep his head in an emergency.

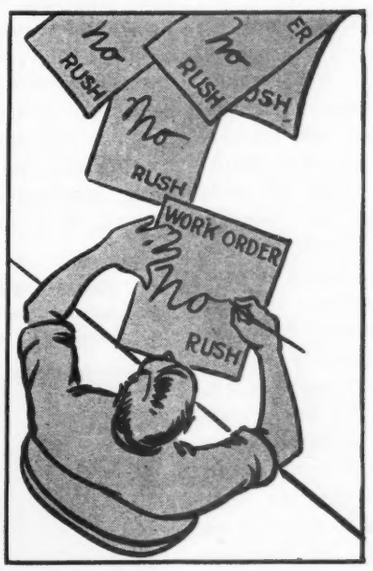
If he has most of the above qualifications, he will keep himself busy with little or no supervision; otherwise he will find many opportunities to loaf and visit. This last item is one of the most troublesome habits of maintenance men.

On the other hand, the construction man should have an inborn desire to build and create things, take pride in a neat-appearing job, and be willing to follow instructions. He should be physically strong and able to work outside in all kinds of weather. It is not necessary that he be a student, since most of his work is done from prints or consists of closely supervised jobs. He should have the ability to look ahead and see the finished work.

The more practical experience he has had, the more valuable he becomes. Construction work in industrial plants is so varied and conduit work is often so difficult that past experience is of more value than technical training in planning and executing the work.

How Get Construction Done?

How, then, are we to handle the many small construction jobs that come up day after day, if the maintenance man is not to do this sort of work? First of all, we may cross off about 20 per cent of the so-called rush jobs if we will just sit down and do a little careful analyzing. Ask any storekeeper of an industrial plant how often a rush call comes in for some material. He 'phones and wires, and finally, with extra charges for rushing the shipment through, the parts arrive, only to lie in the storeroom for days, sometimes weeks.



Check off one-fifth of the rush jobs as unnecessary, schedule the other four-fifths and get a good construction man to do them

The delay in getting the material has allowed time enough for the excitement to blow over, and after some careful planning a better way has been found to do the job.

As to the other 80 per cent of the jobs, they can be arranged in an orderly manner, careful estimates made as to cost, and a work order issued and signed by the proper person, so that there is a permanent record of the job and its cost. When all of the material is on hand, a good construction man can be obtained, and the job completed.

To assume that a construction job done by a maintenance man has no labor cost, is to admit that maintenance inspection and trouble prevention have no value, because when the maintenance man is doing construction work he is not doing the work he should be doing. Nevertheless, it is a puzzle why so many managements will allow a heavy maintenance charge to be placed against a plant and yet fight a small direct charge for new work.

For example, an appropriation is made for a job with the understanding by everyone, all around, that only a small part of the actual labor is to be charged to the job. Of course, every hour spent on that job is paid for, but because it does not show up as a separate and direct charge it seems to pass over as free labor. What it really amounts to, is labor costs on which there is little or no check.

I do not advocate that a hard-and-fast rule should exist that prevents a maintenance man from touching a piece of conduit or doing a small construction job. I have spent more than eighteen years in large industrial plants, and I realize fully that many emergencies arise. However, I have also learned during this time that the number of these emergency jobs can be cut in half by a good maintenance man working under a system that compels him to keep up his end of the job and gives him time in which to do it.

This Maintenance for Controls

Insuring the kind of service that will keep production moving is largely a matter of knowing causes of trouble and removing them

B. W. JONES
Industrial Control Engineering Department
General Electric Company, Schenectady, N. Y.

BETWEEN the electric power lines and the millions of power-consuming devices—motors, heating devices, lights—scattered throughout industry, there are connected an equal number of control devices. These control devices are required to operate many times and be always ready to function. They are rarely ever given a vacation. Therefore it is essential that their maintenance be carried out by those who understand the causes of the troubles which they are endeavoring to prevent.

Looking for Trouble

This article will discuss some of the more common types of trouble which the maintenance force encounters with control devices, show the causes of such troubles, and explain how to stay one jump ahead of them. If the fundamental cause of each trouble is understood the remedy will quite likely be apparent, or ways will be found that will make it possible to lessen the resultant trouble.

One of the most common types of control devices is the contactor. It is called upon to do very heavy work. Sometimes it must carry heavy currents for many hours or days. Often it must make and interrupt large currents at intervals ranging anywhere from occasional to as much as 600 times a minute. It may be called upon to interrupt short circuits where the current may be a hundred times the continuous-current rating, as when a 300-amp. contactor has to interrupt 30,000 amperes.

A contactor has several bolted or spring-closed contacts as will be noted in Figure 1. Excessively high resistance at these contacts is the cause of the very high temperatures, such as 100 to 200 deg. C., that may be reached when the contactor is carrying rated current, or less. The most likely point of high resistance is at the contact where the movable tip *A* makes contact with the stationary tip, *B*. Contact *A* is usually called the active contact.

When Temperature Is High

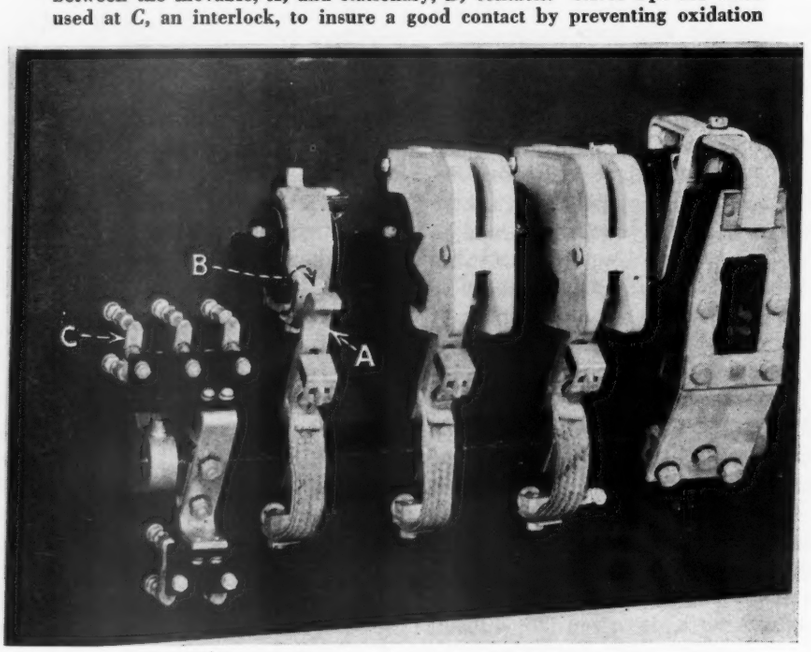
However, high resistance may occur at any of the several bolted joints on the contactor. Therefore, if one of these devices begins to develop an excessive temperature a millivoltmeter should be used to determine which of the several joints has a high voltage drop across it. An a.c. millivoltmeter is now available that can be used for checking the voltage drop on a.c. contactors.

When the contact or contacts that have excessive drop across them have been located, correction can be made by opening the contact and removing the oxide with a file (not with sandpaper or carborundum paper). It is unusual to find a high resistance in a bolted joint unless the contactor has previously reached very excessive temperatures. However, when excessive resistances are found in joints the cause should be removed. Since high resistance will most commonly be found in the active contact, it is a very simple thing to inspect these tips weekly or monthly, and if the temperature is unduly high give them a few strokes with a file.

Remove Oxide, Cut Resistance

The foregoing comments apply particularly to copper contacts, because they oxidize rapidly and the copper oxide formed has a very high resistance. A file will remove the oxide and reduce the resistance to a low value again. It may take about a week, possibly a month, for the formation of sufficient oxide to cause excessive heating under ordinary types of service. However, if sul-

Figure 1. On the contactors a high resistance is most likely to be found between the movable, *A*, and stationary, *B*, contacts. Silver tips are often used at *C*, an interlock, to insure a good contact by preventing oxidation



phur gas is present, a high-resistance film will develop much more rapidly. To prevent this action the contactor should be mounted in a tightly gasketed inclosing case, or immersed in oil.

Sometimes it is not practicable to keep the resistance of contacts low by filing them. When it is desired or necessary to maintain a low resistance of the active contact without servicing, a silver face can be brazed to the two tips so that the contact is made through that metal.

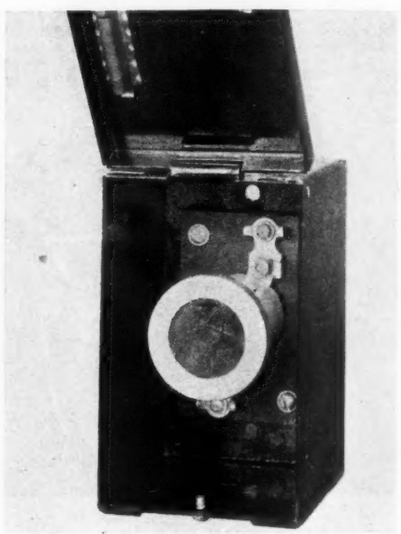


Figure 2. A thermal cutout will protect magnet coils from being burned out in the event of excessive current flow

Silver will oxidize and the oxide has a higher resistance than the pure metal, but, when heated, silver oxide has the unusual property of reverting back to the metallic form. Therefore, silver contacts are self-purifying.

For Severe Service

The auxiliary tips marked *C* in Figure 1, and sometimes referred to as electrical interlocks, may fail to make circuit because of oxidation, where copper contacts are used. Sometimes such failure occurs because dirt gets between the contacts. By using one hemispherical and one flat tip made of silver, both of these troubles will be overcome. The point of the hemispherical tip will make contact without trapping dirt particles between it and the flat tip, and the use of silver will overcome the oxide trouble occasioned by oxidation when copper contacts are used.

Excessive wear on the contact tips of a contactor indicates that it is operated frequently. This type of service will not result in the development of high resistance between the active contacts unless the service is so severe, say several operations a second, that a very high temperature is created. Mechanical wear and the effect of the arc formed when the circuit is opened keep the contacts clean. The contact may be uneven and rough, but this condition will not affect its resistance.

For conditions of this kind silver should not be used on the contacts, because it does not have the ability to stand up under this severe service so well as copper. If the service is unusually heavy, and if the root-mean-square of the current is not more than equivalent to three-fourths of the contactor's rating, the tip can be faced with a certain alloy that will last several times longer than copper tips. The cost of this material is quite high, but its use is sometimes warranted.

Let 'Em Stay Rough

Some maintenance men have the erroneous impression that contact tips that have been roughened by service should be kept smoothed up so that they will carry the load. A roughened tip will carry current just as well as a smooth tip. Of course if a large projection should appear on a tip because of unusual arcing it should be removed. However a tip that has been roughened by ordinary arcing need not be serviced. If a copper tip becomes overheated this condition indicates that oxide has developed and it should be removed.

A large percentage of contactor coil troubles can be traced back to heating. Therefore, if the temperature can be reduced coil troubles can be greatly decreased. Most contactors are designed so that they will function on a minimum of from 80 to 85 per cent of their rated voltage. Since the heating of an a.c. coil will vary as the square of the voltage, whereas heating of a d.c. coil will vary about as the cube of the voltage, it follows that coils should be wound for the voltage that exists on the line.

A supply line may be rated 220 volts, but the voltage may be 240 volts. If the ambient (room) temperature is high this precaution is all the more important. Under these circumstances one may even go a step farther and order coils wound for 250 volts, provided the line voltage does not go much lower than a minimum of 220 volts.

When an a.c. magnet, such as a solenoid, is supplied with constant-voltage excitation it requires a large inrush of current to close the armature. Sometimes armatures may not close because of excess friction or for some other reason and the large inrush current may burn out the coil within a few seconds.

Such mishaps can be prevented by

Preventing Coil Burnouts

the use of a thermal cutout, Figure 2, that will protect the coils, if the correct size of unit is selected. These thermal cutouts are listed for the protection of certain sizes of a.c. motors. If the current that is taken by the solenoid after it is closed is considered to be the equivalent of the full-load current of the motor, the correct size of unit can be selected from the motor table. When the thermal cutout opens because the armature fails to close, it is merely necessary to replace a small link made of two pieces of metal held together by a low-melting-point solder.

A succeeding article to appear in an early issue will take up maintenance of resistors, relays, and associated equipment.

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A. G. M. A. Ratings

THE American Gear Manufacturers Association has recently adopted "Recommended Practices for Rating Helical and Herringbone Speed Reducers and Heavy Duty Worm Gear Speed Reducers."

Different types of service encountered in everyday use are indicated by service factor or class. The old practice of specifying horsepower and speed without reference to stresses, limitations of wear in teeth, and the like, has been discarded.

Technical committees of the Association have taken several years to work out these practices and, since their adoption, almost unanimous endorsement has been given by the gear industry.

EQUIPMENT NEWS

Blueprinting Machine

Uses incandescent lamp; can be plugged into any 110-volt light socket. Prints made with exposures of ¾-1½ minutes. Time switch cuts off current at end of exposure selected. Washing and fixing trays and drying boards provided in base. Will make 18x24-in. or smaller prints. Model 200. Milligan & Wright Co., 4600 Prospect Ave., Cleveland.

Fuse-Puller

Known as "Combination" Test-Light and Fuse-Puller. Resembles pair of pliers; made of molded, reinforced plastic and is non-conducting; 7 in. long. Will test circuits of 110-550 volts and will remove 30-100-amp. fuses. Test pins mounted in handle ends; test-light inclosed in one handle. Flexible extension leads 18 in. long. Ideal Commutator Dresser Co., 1208 Park Ave., Sycamore, Ill.

Pump

Vortex "Black Arrow." Single-stage centrifugal. Sizes 2-14 in.; capacities 30-10,000 gal. per min. For heads up to 300 ft. Double suction, horizontal split-casing type. For general pumping service. Lawrence Pump and Engine Co., Lawrence, Mass.

Bearings

Ball. Three sizes—40, 45, and 50 mm. bore added to "GreaSeal" line. Series 7000 has single felt seal, series 7000-P has single felt seal and plate shield, series 77000 has double felt seal. Two latter series fully inclosed. All series have felts fitted between removable plates. Norma - Hoffmann Bearings Corp., Stamford, Conn.

Welding Manipulator

Consists of faceplate operated by electric motor. Motor controlled by pushbutton mounted on extension cord. Plate can be tilted or rotated to any desired position with operator riding with the work. Capacity 5-7 tons. Manufacturer claims large savings in welding time. United Engineering and Foundry Co., Pittsburgh.

Steam Traps

Two models. Style "AU" with union connection is of bronze construction, and for use on radiators and unit heaters where reduced high pressure steam is used. Bellows of phosphor bronze with end plates brazed on. For pressures up to 150 lb. Style "C" of cast iron construction is angle type with brazed bellows. For pressures up to 200 lb. Valves and seats of hardened stainless steel. W. H. Nicholson & Co., 228 Oregon St., Wilkes-Barre, Pa.

Starter

Type TM-7½. Manual operation; 7½ hp. Across-the-line type with silver-to-silver contacts. Thermostatic overload protection by interchangeable heater units. The Trumbull Electric Mfg. Co., Plainville, Conn.

Switch

Continental Vacuum Power. Solenoid controls position of contacting mechanism which is sealed in high vacuum chamber. Chamber hermetically sealed in metal container. Can be used in corrosive, inflammable, and dust-filled atmospheres. Can be used for remote control and high voltage installations. Operating speed variable, maximum at full load 100 contacts per minute. Two types, both single-pole, single-contact; VPS-1 normally open, VPS-2 normally closed. Cylindrical in shape, 5¾ in. high, 1½ in. diameter. Maximum rating 2 kva. Continental Electric Co., St. Charles, Ill.

Cart

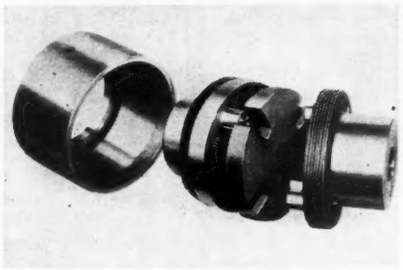
Known as "AYRGO" Modern Material Cart. For liquid or dry materials. Liquid volume of 11 cu.ft.; will handle 1,900-lb. load. Body of steel sheets with welded joints. Steel wheels, roller bearings, pneumatic tires. Long handles provide full control while dumping. Tread, 36 in.; weight, 260 lb. Pittsburgh-Des Moines Steel Co., Neville Island P. O., Pittsburgh.

Hoist

Two-ton "Lightweight." Cranking ratios of 4 to 1 and 22 to 1. Positive internal brake. Cable drum 4 in. diameter, 6 in. wide, with flanges 2¼ in. deep. Steel construction; red enamel finish. Weight, 63 lb.; dimensions, 13x14x9¾ in. Beebe Bros., 2724 6 Ave. S., Seattle.

Belt Cutter

Cut is made by pushing knife through belt from one edge to the other. Replaceable knife is mounted on plunger in slot, operated by direct arm push. Belt hold-down clamp serves also as blade guard. Clamp and frame of aluminum alloy; knife of alloy steel. Cuts flat belt up to 8 in. width. May be used on bench or upended on floor. Called "Alligator Belt Cutter." Flexible Steel Lacing Co., 4607-31 Lexington St., Chicago.



Coupling

Self-aligning; manufacturer claims it will run off $\frac{1}{8}$ in. parallel and 3-6 deg. angular alignment. Two driving hubs into each of which two lugs are set. Lugs fit into recesses along which they may slide in a drive disk of bone fiber. Disk tends to float due to centrifugal action. Cover housing incloses coupling and acts as guard. Called "Lifetyme Uniflex Coupling." Alloy Products Corp., 221-241 Madison St., Waukesha, Wis.

Gasifier

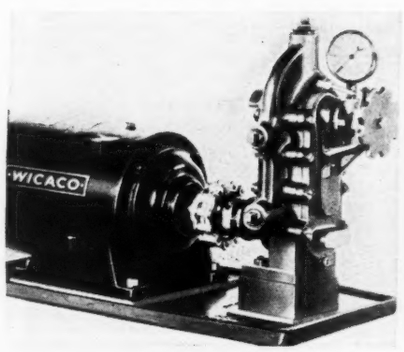
For gas-fired furnaces. Changes oil to gas. Manufacturer claims that savings in fuel costs as high as 75 per cent are possible. Rests on vent of furnace which needs no change in burners. Three sizes. Potentiometer or millivoltmeter type of control. Chicago Flexible Shaft Co., Roosevelt Rd. and Central Ave., Chicago.

Liquid Rubber

Can be sprayed onto surfaces. Especially suitable for spray booths; can be easily stripped off when walls become dirty. Manufacturer claims that it has quick drying and curing properties. Schipper Associates, 1235-36 Lafayette Bldg., Detroit.

Pump

For fuel oil. Two-stage, adjustable metering pump. Operates at 200 r.p.m. Constant feed. Passes and burns normal sediment. Manufacturer claims



savings in fuel costs due to pump's ability to burn No. 6 oil. Various capacities, with or without electric drive. Type C-F. Wicaco Machine Corp., Wayne Junction, Philadelphia.

Flow Meter

Orifice and mercury manometer system of flow measurement. Small changes in mercury volume do not affect accuracy. Different ranges of operation possible by changing orifice or high-pressure leg of manometer. Check valves, operating by gravity, prevent loss of mercury. Metal body of forged steel. Hardened stainless steel, leak-tight stuffing box lapped to shaft. Parts are counterbalanced. For working pressures up to 1,000 lb.; special meters for pressures up to 3,000 lb. Available as indicators, integrators, recorders, or controllers. Suitable for use with orifice plates or venturi tubes. The Bristol Co., Waterbury, Conn.

Metal-Marking Machines

Two. One has single wheel of letters and numerals; other is multiple-wheeled with 2-9 wheels. Guide plate makes possible alignment and uniform impression of letters. Made of hardened and tempered tool steel for impressing metal up to Brinell hardness No. 415. Quality Die Co., 93d and Baltimore Ave., South Chicago, Ill.

Conveyor

Heavy duty wheel. Pressed steel wheel 4 in. diameter. Continuous load rating of 300 lb. per wheel. Twelve $\frac{3}{8}$-in. diameter hardened steel balls assembled in hardened steel ball race. Inner race bored for $\frac{3}{4}$-in. diameter bolt by which wheel is fastened to frame rail. Frame rails 4 in., 5.4 lb. channels. Width of conveyor made to individual specifications. Type 524. Matthews Conveyor Co., Ellwood City, Pa.

Motors

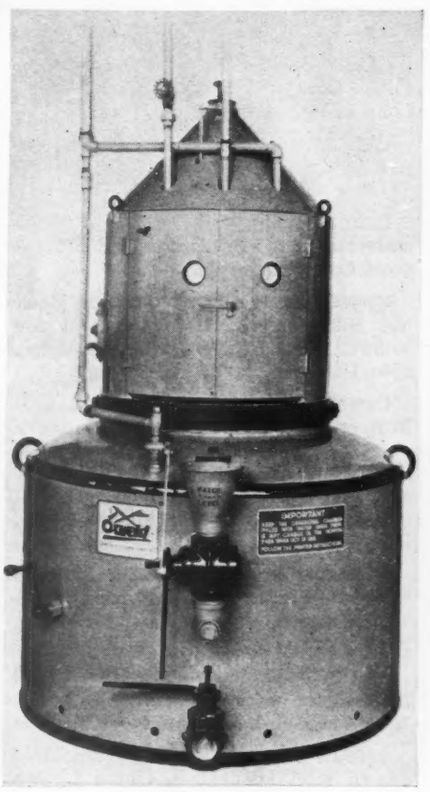
"Flea Power" line. For 110 volts a.c. or d.c. Induction and series, backgeared motors with built-in speed reducers. Induction types cooled by small rotary blowers. Any speed combinations can be had, but shaft speeds of 9 & 36, 1 & 4, and 4 & 18 are standard. Feet for horizontal or vertical mounting. Oil reserves for long continuous operation. Speedway Mfg. Co., 1834 S. 52 Ave., Cicero, Ill.

Firedoors

Known as No. 647 "FyeR-Ward" Flat-Surface, All-Steel, Firedoors. Made up of 22-gage galvanized steel in panels 10 in. wide extending full length of door. Can be finished to represent wood grain or slab-type door. Panels are channel-shaped, interlocking members with legs of channels forming panels in each side of door, staggered so that there is flange every 5 in. Steel rods, 18 in. on centers, extend horizontally through holes in flanges. Sheet of corrugated asbestos interwoven around flanges insulates and serves to form two air spaces. Door thickness, $1\frac{1}{8}$ in.; weight, about 5 lb. per sq.ft. Swinging, sliding, or vertical-lift types in sizes approved by National Board of Fire Underwriters. Standard firedoor sash for glass can be built in where localities permit use of glass. Richards-Wilcox Mfg. Co., Aurora, Ill.

Acetylene Generator

Medium-pressure type for stationary service. Carbide capacities of 150, 300, and 500 lb. to generate acetylene in quantities 300 to 1,000 cu.ft. per hr. Withdrawal of gas operates diaphragm-type feed control which opens feed



valve, releasing carbide in amounts necessary to maintain constant pres-

sure. Controls protected by housing which can be padlocked. Rapid emptying and recharging by means of lubricated plug valves for draining residue and adding water and large door for carbide charging. Oxweld Type MP-5. The Linde Air Products Co., 205 E. 42 St., New York.

Hoist

Called "Pul-Lift." May bc used in horizontal or vertical positions. Capacities, ¾, 1½, 3, and 6 tons. Gear reductions on large capacities. Self-actuating load brake. Moving parts completely inclosed. Heat-treated, alloy steel gears; load hooks of heat-treated, drop forged steel. The Yale & Towne Mfg. Co., Philadelphia.

Correction

In the July issue, illustration of a pump manufactured by the Homelite Corp., Port Chester, N. Y. was erroneously shown under announcement of a pump of the Gardner-Denver Co., Quincy, Ill.

TRADE LITERATURE

BELTING—Folder, on belt preservatives.—E. F. Houghton & Co., 240 W. Somerset St., Philadelphia.

BOILER—Bulletin, on C-E Bent Tube boiler, Design VM.—Combustion Engineering Co., 200 Madison Ave., New York.

CABLE — Booklet, title "Advance in Cable Design."—General Cable Corp., 420 Lexington Ave., New York.

CAPACITORS—Bulletin GEA-77H, on G-E Pyranol Capacitors. — General Electric Co., Schenectady, N. Y.

CART—Leaflet, announcing AYRGO material cart.—Pittsburgh-Des Moines Steel Co., Pittsburgh.

COMBUSTION CONTROL — Data Book No. S-20, on combustion control for boilers. — Smoot Engineering Corp., 2240 Diversey Parkway, Chicago.

COMPRESSORS—Two bulletins: L-620-B6B, on types VS and VA2 for laundry presses and general industrial uses; L-620-B5A, on types VS and VA-2 for oil- and gas-engine starting.—Worthington Pump and Machinery Corp., Harrison, N. J.

CONTROL SYSTEM—Bulletin 37R, on "Dubl-Response" control system. — Taylor Instrument Cos., Rochester, N. Y.

CRANE — Folder, describing CT-50 Loadmaster mobile crane. — Bucyrus-Erie Co., South Milwaukee, Wis.

DRAWN STEEL — Folder, on cold drawn steel shapes. — Union Drawn Steel Co., Massillon, Ohio.

DUST CONTROL—Folder, title "Out of the Realm of Dust."—Pangborn Corp., Hagerstown, Md.

ELECTROPLATING — Leaflet, announcing Handiplater for small plating jobs. —The Udylite Co., 1651 E. Grand Blvd., Detroit.

FIREDOORS — Folder F-93, showing all steel firedoors. — Richards-Wilcox Mfg. Co., Aurora, Ill.

FLOAT—Bulletin No. 635, announcing welded steel float for steam traps, liquid level controls, etc. — W. H. Nicholson & Co., 227 Oregon St., Wilkes-Barre, Pa.

FUSE-PULLER—Leaflet, showing combination test-light and fuse-puller.—Ideal Commutator Dresser Co., 1208 Park Ave., Sycamore, Ill.

GAGES—Catalog PGA-35, on indicating and recording gages. — The Hays Corp., Michigan City, Ind.

GRINDER — Folder, showing Handee grinder.—Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago.

HOIST—Folder, announcing Pul-Lift, a hoist for vertical and horizontal use. —The Yale & Towne Mfg. Co., Philadelphia.

HOIST—Leaflet, showing 2-ton, lightweight hoist.—Beebe Bros., 2724 Sixth Ave., S., Seattle.

INSULATION RESISTANCE TESTING—Booklet, Pocket Manual of Megger Practice in revised edition covers testing of insulation of practically all types of electrical equipment.—James G. Biddle Company, 1211 Arch St., Philadelphia, Pa.

LIGHTING FIXTURES—Handbook "H," showing Indirect Lighting Luminaires. —Curtis Lighting, 1123 W. Jackson Blvd., Chicago.

LUBRICATION — Catalog, showing equipment and accessories for lubrication jobs.—Alemite Corp., Chicago.

MACHINE TOOLS — Booklet, showing line of machine tools.—Landis Machine Co., Waynesboro, Pa.

METAL WORKING — Folder, showing line of sheet metal working machines. —Niagara Machine & Tool Works, Buffalo, N. Y.

MOTORS—Leaflet, announcing line of small motors.—Speedway Mfg. Co., 1834 S. 52nd Ave., Cicero, Ill.

PACKAGING — Catalog, title "Blue Book of Packaging." — The Gerrard Co., Inc., 2915 W. 47th St., Chicago.

PORCELAIN ENAMEL — Manual, on uses of porcelain enamel.—Porcelain Enamel Institute Inc., 612 S. Michigan Ave., Chicago.

POWER TRANSMISSION — Catalog 56-T, on power transmission equipment.—The Medart Co., 3500 DeKalb St., St. Louis.

PUMPS — Bulletin D-17, on Vortex "Black Arrow" single-stage, centrifugal pumps. — Lawrence Pump and Engine Co., Lawrence, Mass.

PUMPS — Catalog, on Hele-Shaw pumps, motors, and transmissions. — American Engineering Co., Philadelphia.

REGULATORS—Bulletin, describing all types of pressure-regulating equipment.—The McAlear Mfg. Co., 1901-09 S. Western Ave., Chicago.

RUBBER COMPOUND — Booklet, on "Self-Vulc" plastic and liquid rubber compounds. — Self-Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago.

RUBBER PRODUCTS—Catalog, on complete line of standard rubber products. —The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

STEAM TRAPS—Bulletin No. 535, on four types of steam traps.—W. H. Nicholson & Co., 228 Oregon St., Wilkes-Barre, Pa.

SWITCH — Folder, announcing heavy duty safety switch.—The Electric Controller & Mfg. Co., Cleveland.

SWITCH — Leaflet, announcing Vacuum Power Switch.—Continental Electric Co., St. Charles, Ill.

THERMOMETERS — Catalog No. 1125, on complete line of thermometers. — C. J. Tagliabue Mfg. Co., Park and Nostrand Ave., Brooklyn, N. Y.

TRANSMISSION APPLIANCES — Booklet, showing transmission appliances. —SKF Industries, Inc., Front St. & Erie Ave., Philadelphia.

WELDING—Leaflet, showing welding hood.—E. D. Bullard Co., 275 Eighth St., San Francisco.

On the Calendar

AUGUST

——**November 11.**—California Pacific International Exposition, San Diego. Headquarters, Administration Bldg., Balboa Park, San Diego.

20-23, American Foundrymen's Association, annual convention, Toronto, Canada, C. E. Hoyt, executive secretary-treasurer, 222 W. Adams Street, Chicago.

28-31, Eighteenth Annual Conference on Industrial Relations, Silver Bay on Lake George, N. Y. Auspices of The Industrial Department of the National Council of Y. M. C. A.'s in cooperation with a committee of industrial men. E. C. Worman, secretary, 347 Madison Ave., New York.

30-31, National Association of Foremen, annual convention, Battle Creek, Mich. E. H. Tingley, secretary, Refiners Bldg., Dayton, Ohio.

SEPTEMBER

3-6, Illuminating Engineering Society, annual convention, Cincinnati. D. W. Atwater, general secretary, 29 West 39th Street, New York.

11-21, National Machine Tool Builders Association, exposition, Cleveland. W. P. Kirk, chairman, Exposition Committee, 1220 Guarantee Title Bldg., Cleveland.

18-20, National Industrial Advertisers Association, 1935 convention, Pittsburgh. D. Clinton Grove, general chairman, P.O. Box 1198, Pittsburgh.

NOVEMBER

12-15, International Acetylene Association, 36th annual convention, Cleveland. H. F. Reinhard, secretary, 30 E. 42d Street, New York.

DECEMBER

2-7, 15th Exposition of Chemical Industries, New York. Headquarters, Grand Central Palace, New York.

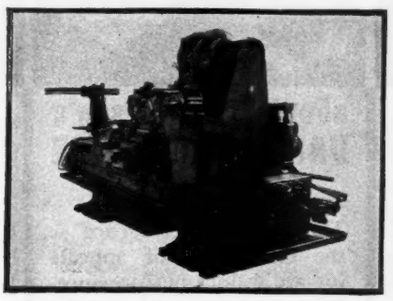
MACHINE TOOLS GO MODERN WITH CHAIN DRIVES

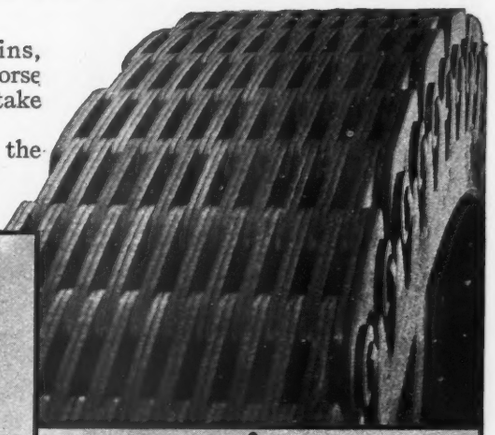
At the Machine Tool Show (and surely you will be there) you'll quickly realize the preference Machine Tool Manufacturers have for chain drives. Although proved in use over a period of many years, this type of transmission is really the modern drive. No other drives have been discovered that are as reliable, positive, efficient and long-lived as silent or roller chain drives.

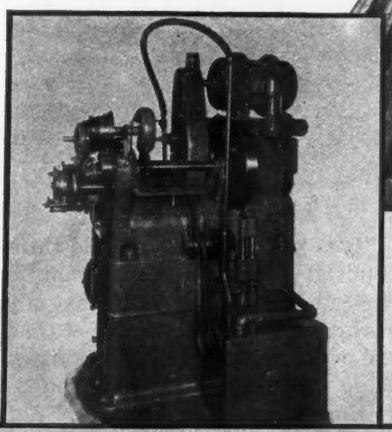
Modernization—the topic of the show, can well begin with a thorough consideration of power transmission in your own plant, as well as on the tools you make. Increased production at lower costs—the real result of modernization, has come from a study of this production factor.

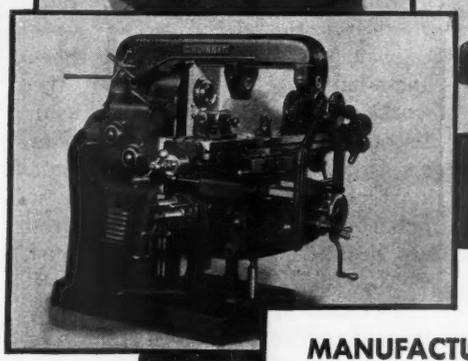
You'll find it worth your while to visit the Morse Chain Exhibit at the show—Morse, as you know, is one of the largest manufacturers of silent chains, roller chains, couplings, and clutches. Morse engineers will be on the job to take good care of you.

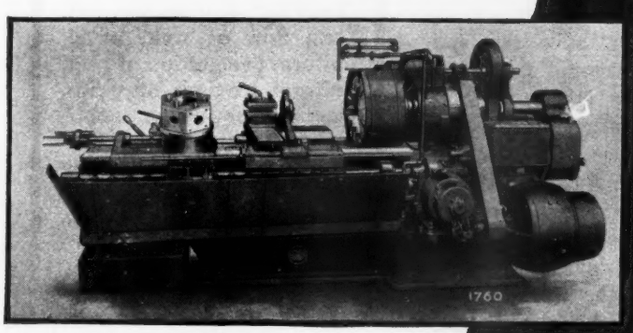
But, by all means, visit the Machine Tool Show at Cleveland.











LEADING MACHINE TOOL MANUFACTURERS USE MORSE SILENT AND ROLLER CHAINS

Abrasive Machine Tool Co.
Acme Machine Tool Co.
American Tool Works
Avery Drilling Machine Co.
Barber Coleman Machine Co.
W. F. & John Barnes Co.
Barrett Machine Tool Co.
Bradford Machine Tool Co.
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Builders Iron Foundry
Carlton Machine Tool Co.
Cincinnati Grinders, Inc.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Cone Automatic Machine Co.
Consolidated Machine Tool Corp.
Davenport Machine Tool Co.
DeVlieg Machine Tool Co.
Fellows Gear Shaper Co.
Foote Burt Co.
Gisholt Machine Co.
Heald Machine Co.
Hendey Machine Co.
Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Landis Tool Co.
Landis Machine Co.
Lodge & Shipley Machine Tool Co.
Monarch Machine Tool Co.
National Acme Co.
New Britain Gridley Machine Co.
Norton Company
Rockford Drilling Machine Co.
Rockford Machine Tool Co.
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MORSE CHAIN COMPANY, ITHACA, N. Y.

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P&H ELECTRIC HOISTS

The handling of materials is just as much a part of your cost as the materials themselves. Move them more efficiently, perhaps stack them higher — to increase your profit margin.

Check your handling costs again. Even the slightest saving per lift may pay for your first hoist, or the change over of a misapplication to a high hook installation as illustrated. Frequently we find "push-on-the-load" types have outlived their usefulness and trolley drives are more profitable units to employ.

Ask us to send you a copy of Bulletin RH-2, which illustrates the right types of hoists for dozens of uses.

HARNISCHFEGER CORPORATION
Established 1884
4525 W. National Ave. Milwaukee, Wis.

P&H ELECTRIC HOISTS

A Pay Check Every Week

(Continued from editorial page 332)

•

Assuming that the company sells a normal volume each year, the management is in the precise relationship of a sales agent for the labor of its employees. We agree to set aside so many dollars to purchase the number of hours of labor for making so many dollars' worth of shoes, and agree to pay for all additional hours at a corresponding rate. The employees are entirely free to split up this wage fund in any manner that suits them, to make any rules or regulations they wish for the handling of labor.

For example, the question arose early in this negotiation: Does the worker get time-and-a-half for overtime?

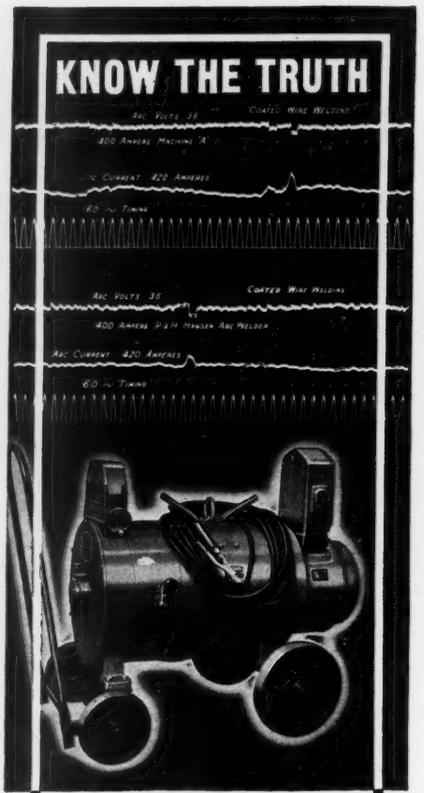
"It's Your Money"

"It is your money," we told them. "Split it up the way you want to. Remember this, though, that the worker who puts in overtime at time-and-a-half is benefiting at the expense of his fellow-workers who are getting fewer hours of work. Suit yourselves, though."

They, not we, decided that time-and-a-half begins only after the worker has worked an extra hour that day, that on Saturday (when we are normally closed) time-and-a-half starts only after noon. It was in precisely this fashion that the workers decided that for absentees, no work, no pay.

You can, of course, see just how this agreement suits both employees and management. Employees are assured as much work and money as they could possibly have received under the old system, and are guaranteed 52 pay checks. Management has a genuine incentive to level production, since it will be less simple to negotiate under this plan for a downward revision of salaries than it was to put up a notice, "We will work only four days this week."

Under this plan the workers will be much interested in keeping out slackers who will not cooperate with them in making the best shoes possible in the most efficient way. The employees as a group will receive any benefits attained from greater cooperation, and it seems a safe as-



about P&H-Hansen's UNIFORM WELDING CURRENT

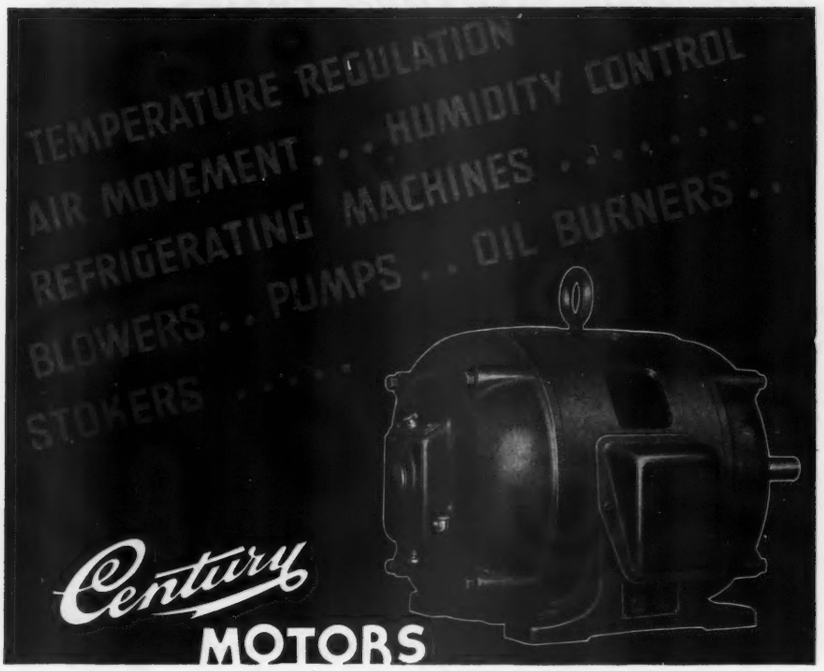
The oscillograph record is the final court of appeals for arc welder performance. When you want the truth, ask for the record of this delicate instrument which plays no favorites—which detects every variation in voltage and amperage.

Ask for the record of a P&H-Hansen. Compare it with others. P&H-Hansen generators need no external resistors, reactors or stabilizers because uniform current is "built in". It gives you uniform flow of weld metal, uniform penetration of heat, uniform strength of welds. Operation is further simplified with single current control over the entire welding range.

Investigate! There's a new edition of Bulletin "Weld It Well". Write today for your copy.

HARNISCHFEGER CORPORATION
Established 1884
4525 W. National Ave. Milwaukee, Wis.

P&H HANSEN ARC WELDERS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AIR MOVEMENT . . . HUMIDITY CONTROL
REFRIGERATING MACHINES . . . . . .
BLOWERS . . PUMPS . . OIL BURNERS . . .
STOKERS . . . . . .
Century
MOTORS

for every type of AIR CONDITIONING REGULATION . . CONTROL

Manufacturers of Air Conditioning Equipment realize that EXACT CONTROL of *Temperature, Humidity and Air-Movement* is the chief essential in assuring continuously satisfactory operation—in both general installations and the most exacting commercial and processing applications . . .

That is why they pay the same rigid attention to details of design and construction that has achieved outstanding recognition for Century Motors for more than 31 years . . . "They Keep-a-Running"

• UP TO 600 HORSE POWER

Consult Century Engineers . . . They are fully equipped by long experience to recommend the right type, size and design of motor for developing new products or bettering the performance of established ones.

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MOTORS

UP TO 600 HORSE POWER

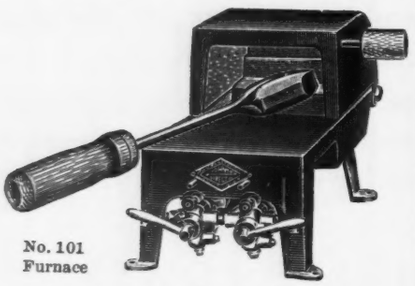
Machine-finished CHAINS
FOR Pro-phy-lac-tic's
machine-finished BRISTLES

Machine-finished Baldwin-Duckworth Roller Chain keeps the machinery on which Pro-phy-lac-tic tooth brushes, and thousands of other well known articles are made and packaged, operating steadily, evenly and economically. Available in any pitch and in single or multiple strand. Send for catalog. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

BALDWIN—DUCKWORTH

JOHNSON No. 101
BENCH FURNACE

Heats Soldering Coppers
Without Forced Air Blast



No. 101
Furnace

This famous Johnson Bench Furnace heats soldering coppers up to 12 lbs. per pair. It may also be used for tempering, heat-treating, annealing, or case-hardening carbon steel tools or small metal parts. Quick, intense heat is provided by two powerful Johnson Bunsen Burners . . . . No blower is needed. One of the most widely used bench furnaces on the market. Write for free catalog.

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No matter what your insulation problem may be we should be able to help you. We manufacture all forms of laminated insulation—DIAMOND FIBRE—DILECTO—CELORON — VULCOID — CELLULAK — CODITE — therefore our recommendations will be without prejudice.
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Continental-Diamond Fibre Co.
NEWARK, DELAWARE

sumption that they will work it out at a considerable saving.

If they devise ways to cut costs, the management will be delighted to let them keep all they save. The savings are there, all the time, as what might be considered an additional competitive margin of safety. So are savings that may be made by labor-saving machinery.

If competition cuts production costs and can undersell us, our people will cheerfully give up a slice of these cost-savings to keep their company running and providing work—just as any intelligent manufacturer would willingly give up part of his profit rather than see his best and most productive sales agent forced out of business.

Some of the stockholders who are not closely in touch with the management of the business arose on our announcement of the agreement to demand an explanation of why we entered into any such contract. To them it appeared that we had somehow signed away our divinely granted rights as an employer to hire and fire and lay off as suits our purse. And at first glance, it admittedly looks this way.

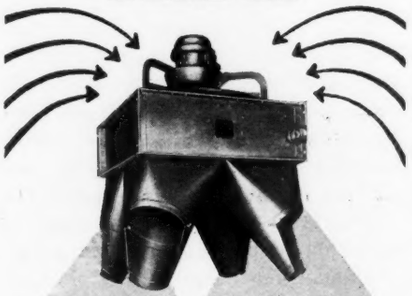
Unity of Interest

The answer, of course, is that we did not leap into the plan headfirst. Our labor relations are such that our people have real confidence in our fairness. Their officials, particularly their president and their business agent, show a sympathetic understanding of the unity of interest between company and employees. They tell us that experience has built up in their minds the belief that, when the management comes to them for a concession, there is an authentic need for it and that it is entirely fair in the management's opinion.

We, in turn, have so regularly found the shop union officials open-minded that we anticipate no misunderstandings or stubborn unwillingness to be reasonable. Our relationship is built on confidence in each other. We both, in brief, have the mental attitude of, "Well, why not?" when the other fellow makes a proposal.

Furthermore, payroll is by no means the only important element in the cost of making and selling shoes. In fact, we use a large volume of expensive materials; we pay a good

A
FLOOD-LIGHT
of
HEAT



No more Chills to the Bone

. . . by freezing feet and sweltering brow

WING
FEATHERWEIGHT
UNIT HEATERS

provide a steady supply of warmth at the floor level—Mounted near the ceiling, it takes the air at the highest level (preventing an accumulation of unprofitable heat) and forces it down to the floor area, in a perfectly defused stage through high velocity multiple discharge outlets.

SAVES FUEL AND SPACE

Write for interesting Bulletin

L. J. WING MFG. CO., Inc.
162 West 14th St., New York City
AND ELSEWHERE

deal of money per pair for modern shoemaking; we maintain sales and advertising and distributional facilities. All of these aggregate more than the labor cost per pair. They offer a richer field for savings than does the payroll.

Therefore, we see a large potential profit to our company through making this agreement with the factory employees. Rather than fail to provide work at the agreed salaries, every person in the management will bend all his ingenuity to getting the volume and even flow of production that will permit us to meet the terms of the agreement.

Once we attain this, I rely on the momentum thereby gained as sufficient to carry us right on past and yield us excellent profits from these other functions of the business.

One Minor Hurdle

One of the minor hurdles to be overcome when this plan was voted on was the fact that it would decrease the weekly pay check — naturally, since 48 weeks' pay was now spread over 52 weeks. The worker who earned $2,016 last year got it in 48 pays of about $42 each. This year he gets at least $2,016 in 52 pays of $38.77 each, and if he gets any more money for his year's work (except overtime, which is paid from week to week) he will get it in a lump as his share of the factory employees' savings dividend.

This was an objection in the minds of many employees, at first glance— the same psychology that makes the $75 actor consider himself forever after a $300 man when he has filled in one week as understudy for someone of greater ability.

One other advantage is already accruing to us noticeably. For weeks after the plan was briefly announced in the newspapers, we received an unusually heavy mail. Much of it began, "I have never worn your shoes, but since reading of your plan for giving employees steady work and steady pay, I have determined to buy your shoes regularly, as I have always understood they give excellent value." And as we looked over these congratulatory and friendly letters, it would have been difficult to decide who was pleased the more, the union business agent or the president of the company. On that point, we see alike.

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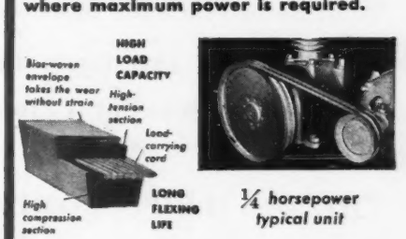

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To Prevent Belt Static

(Continued from editorial page 356)

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The percentage of relative humidity that is dangerous from the standpoint of static in industrial plants depends largely on the nature of the operations and the product. Thirty per cent relative humidity is considered as equal to an open desert. Around Chicago the average humidity of 60 per cent is considered well above the danger point. In some processes, 40 to 50 per cent humidity would cause no trouble, whereas in others humidity as low as this might be almost dangerous.

Humidity below 30 per cent is certainly dangerous and machines should either be grounded or steps taken to raise the humidity, which can be checked with the wet-and-dry-bulb thermometer.

When Voltage Varies

(Continued from editorial page 354)

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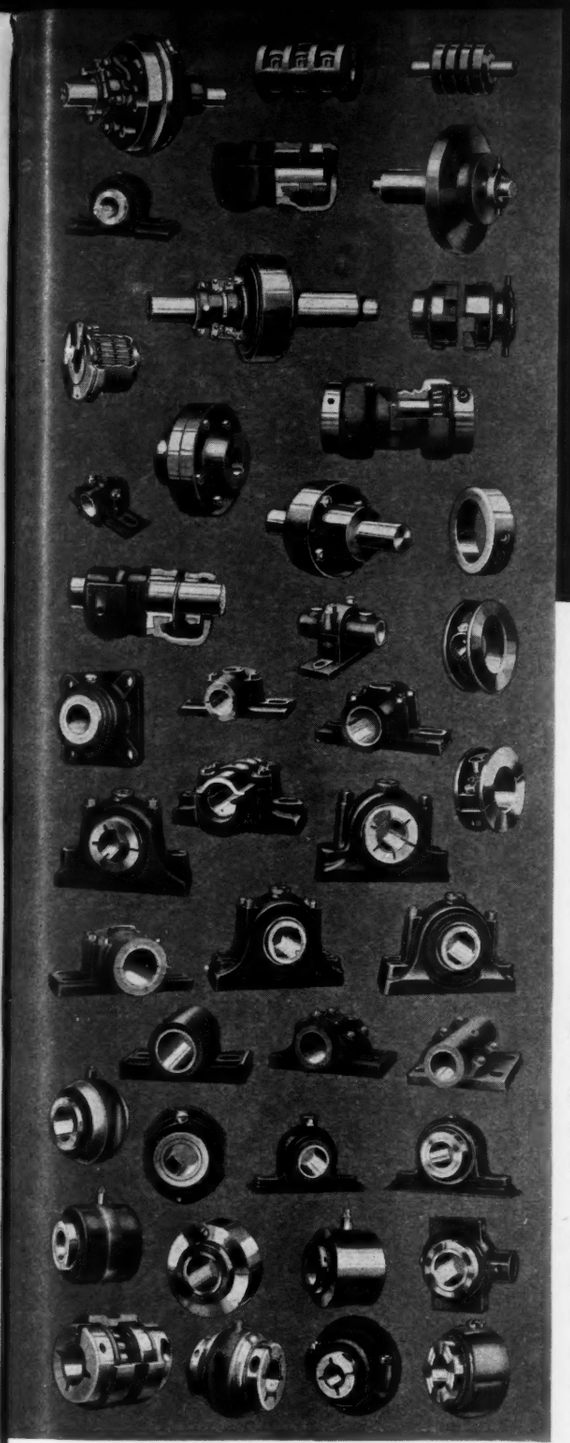
regulator, although it is entirely feasible to provide somewhat different types of regulators to care for frequency requirements.

To clear up any misunderstanding, "sensitivity" as used here indicates the per cent of voltage deviation from normal that will cause the regulator to apply corrective action. Sensitivity, therefore, is usually given in per cent of rated voltage. For example, a regulator having a sensitivity of 1 per cent will initiate corrective action when the regulated voltage deviates 1 per cent or more from normal. This term does not simply mean that the voltage will be maintained within the 1 per cent band, but simply that correction will be initiated when the deviation from normal is more than 1 per cent.

On the other hand, "regulation" is normally interpreted as the zone within which the voltage will remain when under the control of the regulator. This feature also is rated in per cent of normal voltage. However, since all circuits involve electrical inertia in some form or other, time is required for recovery from surges due to load changes or other disturbances. Sudden load increases involve voltage dips that may



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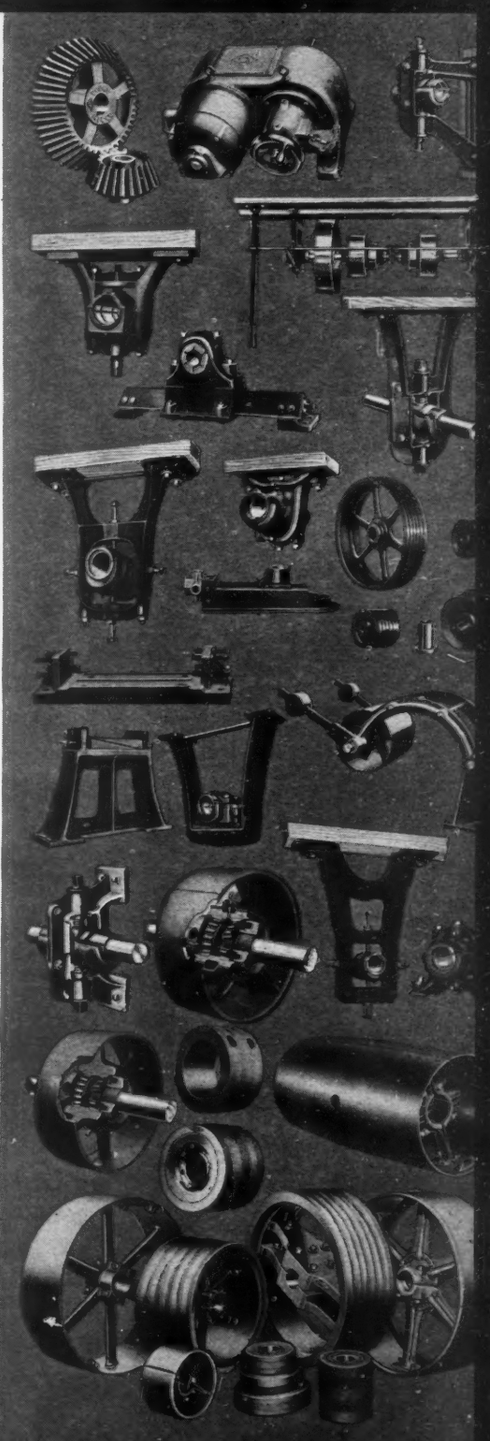
There is no cure-all for power transmission problems. The right way of getting the power to the work is a matter of selecting the equipment best adapted for the particular service. Service conditions should always be the deciding factor in drive selection.

Dodge engineers have helped industry keep pace with present day demand for more efficient and economical production. Let them submit suggestions for profitable modernization. Their recommendations will be backed by fifty years specialized experience.



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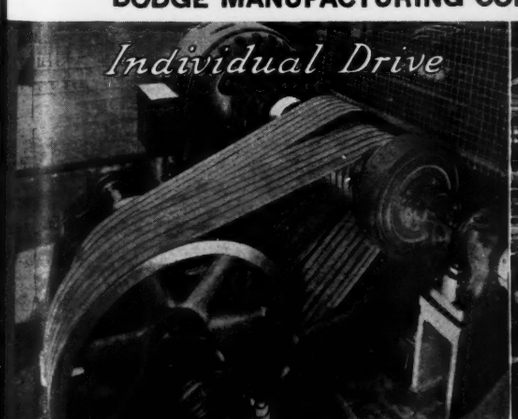

THE Right DRIVE FOR EVERY JOB

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MAKES **FHA** MONEY

PAY

OFTEN the profit possibilities in materials handling are lost sight of because no one takes the trouble to separate materials handling from total production costs. This is a point worth noting in borrowing money under the provisions of the FHA for modernization.

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Salt Lake City—Ambler & Riter
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be so rapid and extensive that, even though the regulator is very fast in initiating correction, the system voltage may drop considerably beyond the value given for the sensitivity of the regulator.

Therefore, the regulation of a regulator is always a much larger per cent than is the rated sensitivity. In view of the many factors that affect the electrical system, the prime mover, and the load, normal practice is to specify regulator performance on the basis of sensitivity, rather than on the regulation desired or obtainable.

Books

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